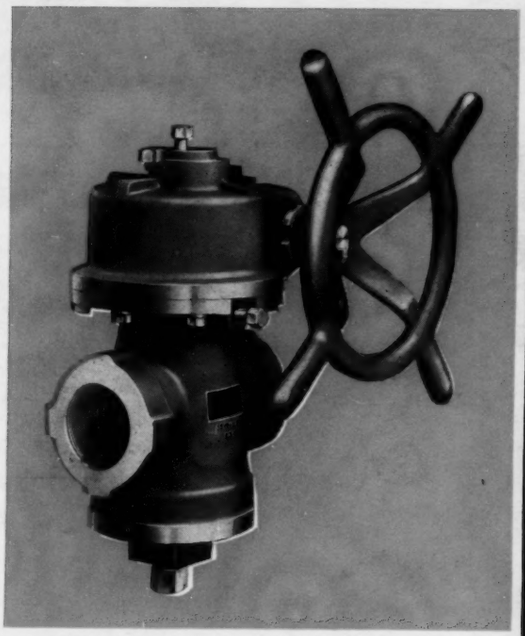
WESTERN GAS

May 1931

20 Cents the Copy

Easy to shut · Easy to open · . . . under Full Pressure



Series 150
3000 lb. Working Pressure
• • •
6000 lb. test Nordstrom Valves

Illustration shows the new 6000-lb. test enclosed worm geared Nordstrom Valve for 3000-lb. working pressure, designed for Xmas tree flow lines and high pressure slush manifolds. It offers greater ease of control. One operator can easily open the valve under a differential pressure of 6000 lbs. per square inch.

For years Nordstrom lubricated plug valves have operated satisfactorily in some of the most severe services in the gas and oil refining industries. The perfected, fully patented Nordstrom Valve with "Sealdport" principle is being adapted to many oil field services, eliminating obstinate valve problems which heretofore were considered unavoidable.

Nordstrom Valves are now available in both iron and cast steel in sizes from ½-inch to 24-inch and for working pressures from 150 to 3000 pounds. Lubricant under pressure seals the valve. There are no pockets for trapping of sand. The seat is fully protected and all bearing surfaces have a film of lubricant. Corrosion and erosion are prevented. There is only one Nordstrom principle. Our field engineers will be glad to discuss Nordstrom Valve features with you. Catalog upon request.

THE PERFECT APPLICATION OF A PRINCIPLE

MERCO

MERCO NORDSTROM VALVE COMPANY
SUBSIDIARY OF THE MERRILL COMPANY . ENGINEERS

Atlanta - Healey Bldg.
Boston - 184 Boylston St.
Buffalo - Genesee Bldg.
Charleston - W. Virginia
Chicago - 176 W. Adams St.
Dallas - Magnolia Bldg.
Detroit - 2842 West Grand Blvd.
El Paso - 111 So. Virginia St.
Houston - Petroleum Bldg.
Los Angeles - 1709 West 8th St.
New Orleans - Masonic Bldg.
New York - 11 W. 42nd St.
Pittsburgh - Clark Bldg.
St. Louis - 317 N. Eleventh St.
San Francisco - 343 Sansome St.

Agencies:

Denver - Republic Supply Company, 332 Continental Oil Bldg.
Honolulu - W. A. Ramsay Co., Ltd., Fort & Queen Streets
Philadelphia - Brown, Wilson & Company, 1600 Arch St.
Saginaw - Arthur C. Beckert, 112 Durand St.
Salt Lake City - National Equipment Co., 101 West 2nd South St.
Tulsa - B.V. Emery & Company, 216 E. Brady Street

Factory - Oakland, Calif.

Canada - Peacock Bros., Ltd., Montreal, Toronto, Winnipeg, Vancouver. (Also Sydney, N.S.)
England - Audley Engineering Co., Ltd., Newport, Shropshire.
Buenos Aires, Argentine, - General Electric, Soc. Anon., Victoria 618 Esq. Peru.

NORDSTROM VALVES

A MONTHLY JOURNAL DEVOTED TO THE WESTERN GAS & APPLIANCE INDUSTRIES

NATURAL GAS EDITION

TODAY'S engineers—constructing one of the greatest transportation systems the world has ever seen—are the Empire Builders of a new era. In their capable hands rests the future of a great industry, dedicated to the task of providing a *dependable* supply of natural gas for tomorrow's industrial and domestic consumers.

These engineers know that soil corrosion destroys buried steel pipe—*unless it is adequately protected.* They insure and prolong the serviceable life of the pipe by applying the time-tested protective coating —*Bitumastic Enamel.*

WAILES DOVE-HERMISTON CORPORATION

17 Battery Place, New York

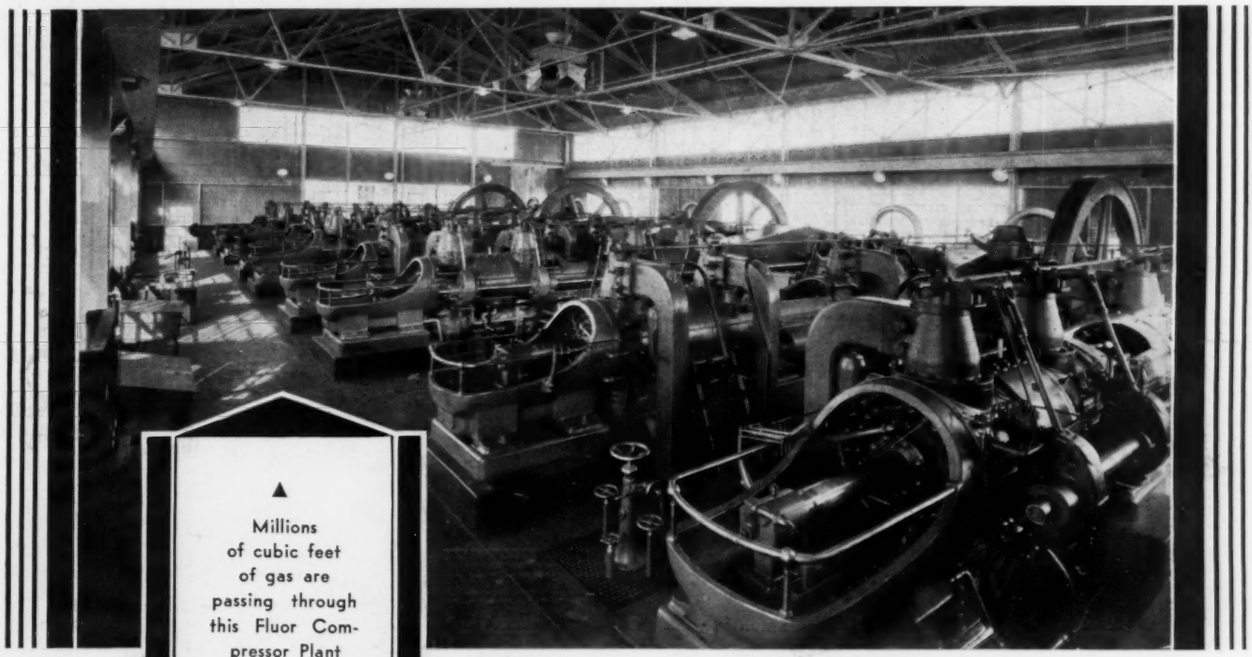
HOUSTON—Petroleum Building
PHILADELPHIA—401 N. Broad St.
CHICAGO—20 N. Wacker Drive

LOS ANGELES—2461 E. 8th Street

CLEVELAND—Union Trust Bldg.
TULSA—Philtower Building
SAN FRANCISCO—345 Vermont St.

Fluor

COMPRESSOR STATIONS



▲
Millions of cubic feet of gas are passing through this Fluor Compressor Plant every day.
▼

+ + + Selected for Mid-Continent Gas Line

FLUOR compressor stations, built by Fluor, have been selected for another large gas line from the Texas Panhandle.

The stations are being completely designed, engineered, and erected by this company, having full cooperation of the owners.

Each station will have at least five 1000 h.p. gas engine-compressor units, complete with pumps and all other auxiliaries, and gas-engine driven power generators.

Fluor plants have many exclusive advanced features essential to modern demands for efficiency and economy, and reliability. They are being selected for the largest and most important projects, by the most critical and careful buyers.

Fluor plants are complete, including office buildings, dwellings, etcetera.

Complete Information Supplied Without Obligation.

THE Fluor CORPORATION, LTD.

Tulsa, Okla. 11 East 5th Ave. | New York, N. Y. 30 Church St. | 909 East 59th St., Los Angeles, Calif. | Dallas, Texas Magnolia Bldg. | Kansas City, Mo. 503 Fairfax Bldg.

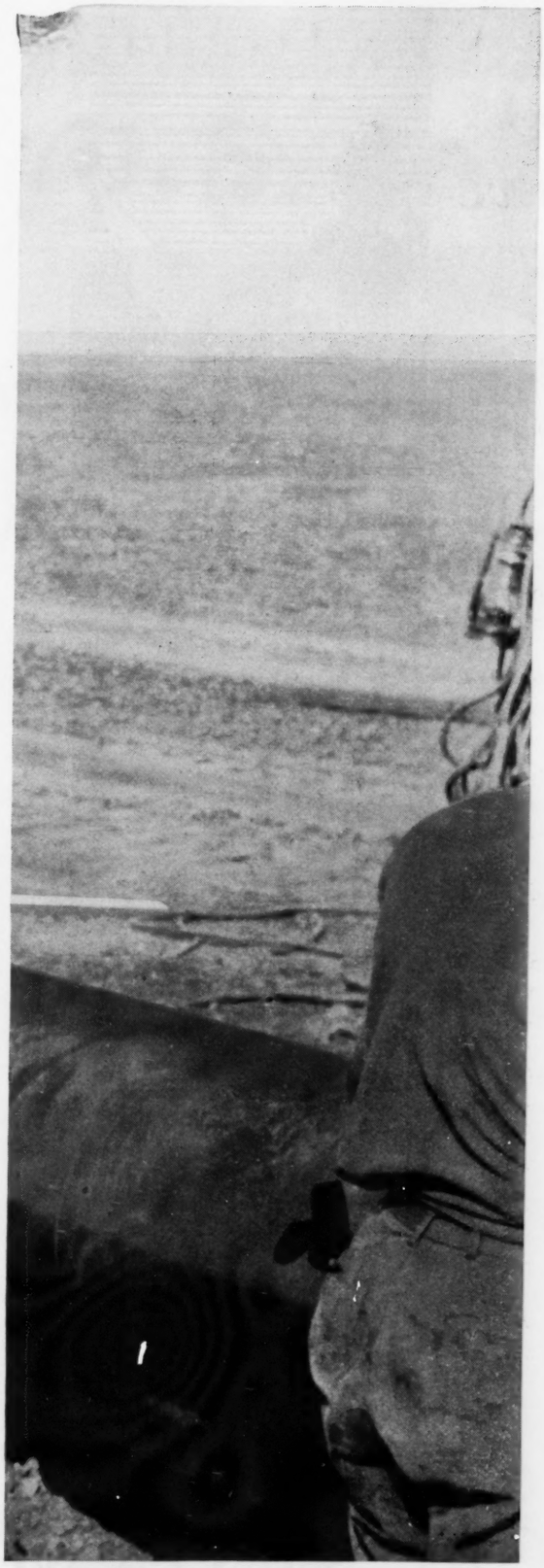
May, 1931, Volume VII, Number 5, Western Gas is published by Western Business Papers, Inc., at 124 West Fourth Street, Los Angeles, California. Subscription price (in advance) 20 cents the copy; $2.00 per year; 3 years $5.00; $3.00 per year foreign. Entered as second class matter June 1, 1925, at the postoffice at Los Angeles, under the Act of March 3, 1879.

The NEW

600 FT. LENGTHS

SMITH WELDED

PIPE LINE AT THE



WITH SMITH Field Welding, the pipe line constructor or contractor can have the pipe delivered alongside the ditch in 300 to 600-foot lengths—with all bends in position—ready to tie in and dump in.

SMITH Field Welding is available to any user of SMITH Welded Pipe.

◆ ◆ ◆ ◆ ◆

A new book, "The New Way of Designing and Building Gas Lines with SMITH Welded Pipe," provides for the benefit of the industry a scientific method, simple in application, to determine the factors effecting a minimum cost of pipe lines. A copy will be sent upon request to anyone interested.

A. O. SMITH CORPORATION

General Offices: Milwaukee, Wisconsin

OIL AND GAS FIELD PRODUCTS DIVISION

District Offices:

New York , Tulsa , Houston , Los Angeles

GAS LINE PIPE

LOWEST COST PER MILE

Progress Demands *Extensive Natural* Gas Service

Progress is the theme prevalent throughout Western Oklahoma; South, East and Central Texas and Louisiana today. These aggressive regions of the United States are making exhaustive use of their natural resources and advantages. As industries increase in number and output . . . as agricultural methods become modernized and improved . . . as population increases and more homes are built . . . so must the facilities for rendering adequate natural gas service be extended In fact, Natural Gas as a power fuel is one of the outstanding reasons why industry has turned its attention to this great region.

Already these territories have accepted Natural Gas as the economical, efficient fuel for homes and industry. With an unfailing supply at their very doors, it is no wonder that this fuel is finding daily use in thousands of homes and industrial plants.

To meet the natural gas requirements of a large section of this territory is an obligation of the United Gas System. To have an adequate supply of Natural Gas ready for new homes and new industries is the purpose of the extensive expansion program now under way.

Many millions of dollars are being expended to improve our facilities for serving this territory. New wells are being drilled . . . pipe lines are being constructed . . . compressor stations built . . . distributing systems extended and service brought to many new communities so that fuel requirements might keep pace with territorial development.

UNITED *Gas* SYSTEM

U. S. de Lavaud Pipe

During the past eight years, more than 10,000 miles of deLavaud Pipe have been specified by engineers and contractors in cities throughout the country.

DeLavaud Pipe is light in weight; easy to cut and tap. And tests have proved that it is at least 25% stronger than good pit cast pipe.

The deLavaud Handbook gives complete details and specifications. For free copy address: United States Pipe and Foundry Co., Burlington, N. J.

Sales offices located in the following cities: New York, Philadelphia, Pittsburgh, Cleveland, Buffalo, Chicago, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, San Francisco, Los Angeles.

CAST Q IRON

Our pipe bears the "Q-check" trademark of The Cast Iron Pipe Research Association

Illustration shows the deLavaud machine in action.

THE 1931 LEADER

1. Distinctive design — smart and modern.
2. Sturdy cast-iron construction.
3. Inverted manifold — no heat-leaking valves.
4. Roomy service drawer — slides smoothly.
5. Bakelite gas valve handles — smart in appearance — cool in operation.
6. Attractive Bakelite pendant door handles.
7. Compact.
8. Oven will hold largest Savory roaster.
9. Grates finished in ebony black vitreous.
10. Porcelain enamel oven linings.
11. Two Grained Porcelain finishes — silver grey with white trim, as shown, and slate green with ivory trim.

THE METROPOLITAN

A New, Distinctive First Quality, Low-Priced GAS RANGE

BY

A-B BATTLE CREEK

TO RETAIL AT LESS THAN

$50

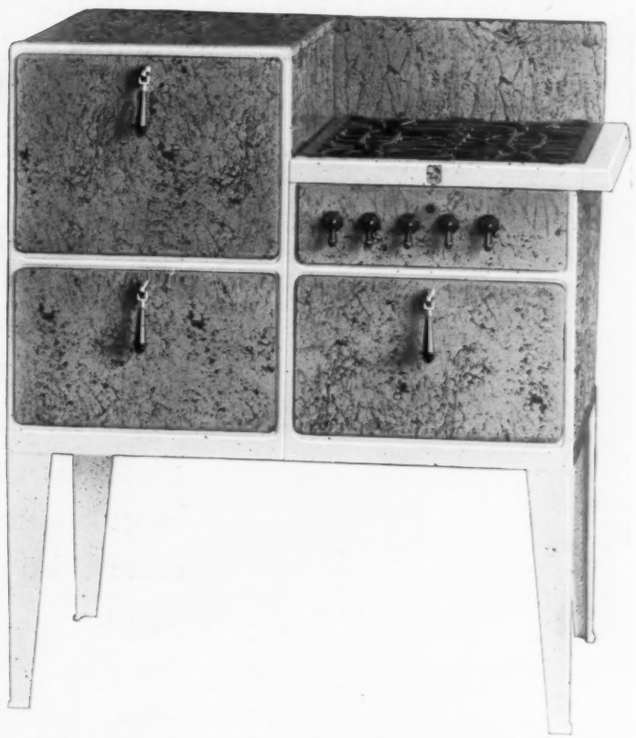
Back of this unusual product is an aggressive merchandising program designed to put the public back in a buying frame of mind. It will help you Build Better Business in 1931.

The details are yours for the asking . . . . No obligation, of course.

A-B STOVE COMPANY

OFFER Outstanding VALUE!

THE METROPOLITAN



FOR

Increased SALES!

Mere "price appeal" alone has lost its punch. Today more than ever before the American Public is interested in *VALUE!*

Sturdily constructed, finished in glistening porcelain inside and out, the Metropolitan offers the consumer *outstanding Value* at an amazing price. It is building volume business—at a fair profit—for hundreds of gas range dealers. . . . Why not for you?

Write or wire at our expense for full details.

BATTLE CREEK, MICHIGAN

S. N. G.

Natural Gas.....

The entire South joins Memphis in welcoming the representatives of the natural gas industry to this section of the country. Your meeting will, no doubt, be profitable and enjoyable, first by the interchange of ideas and by partaking of the traditional southern hospitality in Memphis, a city of charm and distinction.

When you prepare to return home we cordially invite you to stop in Birmingham and visit some of the large industries being served by this company.

The transmission system of the Southern Natural Gas Corporation consists of 1700 miles of main line. Industrial leaders believe that the availability of natural gas in this territory, already possessing many natural advantages, will mean a new era in the industrial progress of the Southeast.

SOUTHERN
Natural Gas Corporation

Watts Building Birmingham, Ala.

14 Ft. per Minute in This Tiny Digging Package

Weighs only 7500 lbs.
Measures only 48" wide
Cuts 3'x5" to 3'x8" ditch
Reversible Spoil Conveyor
Throttling Governor
35 h. p. High Compression Engine
$2800 f. o. b. Aurora

So narrow that it can go through wherever two men can walk abreast —so light that it handles as easily as an automobile—so sturdy, so powerful that it clips off as high as 14 feet per minute and literally walks through the toughest digging.

That is the story on the New Barber-Greene Service Special which is revolutionizing certain types of ditching. But that is only a small part of the story.

Digging 5 to 8 inches wide, this new Barber-Greene disturbs less ground. There is less soil, sod or pavement to replace. Backfilling costs go down as sharply as digging costs.

Weighing but 7500 pounds, the Service Special has more horsepower per pound, and puts more actual horse-power into digging —on less gasoline and oil.

And the price is as sensational as the performance: only $2800 f.o.b. Aurora.

Ask for details today if you do any town, city or narrow trench work.

BARBER GREENE

SPECIALIZING IN INVENTING FASTER AND CHEAPER MACHINES AND METHODS

BARBER-GREENE CO. **712 W. Park Ave., Aurora, Illinois**

Bucket Loaders
Coal Loaders
Snow Loaders
Trailers
Loaders with Weighing and Batching Hoppers
Loaders with Vibrating and Grizzly Screens
Coal and Coke Car Unloaders
Permanent Belt Conveyors
Portable Flight Conveyors
Standard Gas and Water Ditchers
Pipe Line Special Ditchers
Belt Car Unloaders
Portable Belt Conveyors
Self-Propelled Flight Conveyors
Utility Special Ditchers
Service Special Ditchers

MARK THESE DATES

ON YOUR CALENDAR

TO ATTEND THE

ANNUAL

CONVENTION

of the

NATURAL GAS DEPARTMENT

American Gas Association

MAY 11th - 12th - 13th - 14th

MEMPHIS, TENNESSEE

Hotel Peabody

CONVENTION HEADQUARTERS

A constructive program with addresses by leaders in the industry. Entertainment features that will fulfill your expectations of Southern hospitality » » » » » »

MEMPHIS POWER & LIGHT COMPANY

MEMPHIS NATURAL GAS COMPANY

GAS LINE Valve

FIG. 847-F 500 lbs.

This Walworth Steeliron gate valve has already proved its worth on a considerable number of the more important pipe lines in the United States. It's designed for service at pressures up to 500 lbs. per square inch and embodies many engineering features of unusual significance for those who are especially interested in dependable low-cost operation.

The pinion shaft on the gear-operated valves has a two-bearing support. These valves are regularly furnished with a high-pressure grease gun connection and with a lantern in the extra deep stuffing box. Body bonnet discs and yoke are strong, compact castings of Walworth Steeliron.

WALWORTH

. . . Distributors in Principal Cities of the World . . .

General Sales Offices: 60 E. 42nd St., New York

WALWORTH CALIFORNIA CO., 235 Second St., San Francisco

WALWORTH COMPANY, 809 Fourth Place, Los Angeles

Your Local Newspaper Will Give You the Dates These Ads Will Run.

41,000 of our customers
....are thanking electricity for making cooking a pleasure
Cook with electricity — the modern way
P·G·and E·
5 Col. 14"

TIMES may be hard today, but a little more "punch" will get sales.

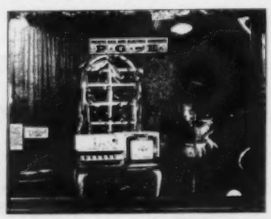
Take the case of Coca Cola .... This concern realized in 1929 that 1930 would be an "off" year ... if nothing was done. So it increased its advertising, "punched" harder, and made more money in 1930 than ever before.

The same principal applies on a smaller scale to every one who makes a living by selling merchandise.

« »

P. G. and E. Advertising is run in every established newspaper in our Territory. The combined circulation of each ad is more than 1,000,000. P. G. and E. Advertising reaches every home where we serve gas or electricity.

"...and she lived happy ever after"
ELECTRIC cooking gives you more leisure.....
costs ½¢ per meal per person.
Cook with Electricity — the modern way
P·G·and E·
5 Col. 14"



Window in Marysville sells Electric Range to family living in Atascadero

Here is a window that did a real job.

It's not often that a window display can be given full credit for making a sale. But believe it or not, here's a window that did the trick.

One afternoon a man and his wife, motoring from Atascadero to Seattle, saw the display. They stopped, entered the store and bought the range shown in the window. When the salesman discovered that the range was to be installed in Atascadero he received the shock of his life.

No doubt this couple passed by other windows displaying electric ranges in the 30 cities along the road to Marysville. But the secret of the success of the one pictured here was, proper lighting.

Colored lights were used in the valance and along the foot of the window. A powerful white spotlight played upon the electric range.

Well arranged windows, properly lighted day and night, will help make SALES for you .... Our Lighting Bureau will gladly assist you in laying out proper window lighting.

DEALER HELP . . . *Exclusively*

Dealers throughout P. G. and E. territory will receive a folder each month, similar to the one reproduced above, showing our principal newspaper advertisements for the current month and showing how dealers may capitalize on our advertising.

Since our advertisements are designed to create prospects and to direct these prospects to dealers' stores, progressive dealers should run their own advertisement along side of ours and tell prospects WHERE they may buy the featured appliances.

Depending upon our seasonal advertising campaign, these dealer folders will contain reproductions either of our gas or electric appliance advertising or both. Thus, dealers can select the advertisements with which they wish to tie-in.

The above reproduced folder is the first of a series and was mailed to dealers during the first part of April. If you did not receive one of these folders, fill in the accompanying coupon and mail it to us at once.

Each month thereafter you will receive one of these helpful folders in time to tie-in your advertising and window displays with this cooperative advertising.

Mail this Coupon today.

PACIFIC GAS AND ELECTRIC CO.,
245 Market Street,
San Francisco, California.

Gentlemen:

Without any obligation on my part, I should like you to place my name on your mailing list so that I will receive a folder each month showing P. G. and E. advertising and explaining how I may direct prospects to my store.

Name .....

Address .....

City ..... California

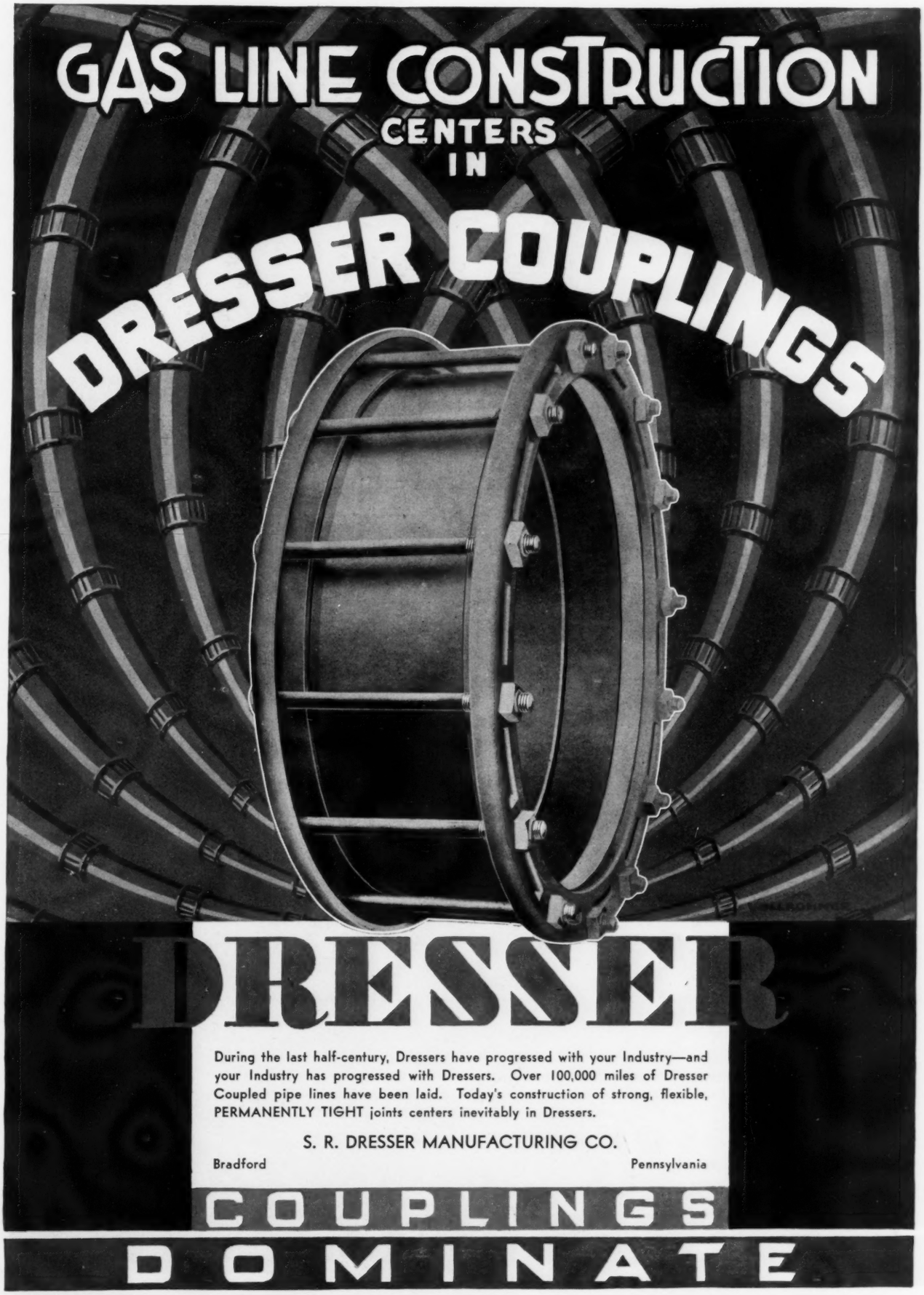
Business .....Appliance Dlr.
(gas and/or electric)

269-531 WG

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·

Owned · Operated · Managed
by Californians


GAS LINE CONSTRUCTION
CENTERS
IN
DRESSER COUPLINGS
DRESSER
During the last half-century, Dressers have progressed with your Industry—and your Industry has progressed with Dressers. Over 100,000 miles of Dresser Coupled pipe lines have been laid. Today's construction of strong, flexible, PERMANENTLY TIGHT joints centers inevitably in Dressers.
S. R. DRESSER MANUFACTURING CO.
Bradford
Pennsylvania
COUPLINGS
DOMINATE

Memphis' Ever Ascending Skyline

WHERE A REAL WELCOME AWAITS US—

WE WERE GLAD TO ENTERTAIN THE NATURAL GAS CONVENTION IN NEW ORLEANS LAST SPRING . . . AND WE ARE SURE THAT ANOTHER REAL SOUTHERN WELCOME AWAITS CONVENTION DELEGATES WHO WILL MEET IN MEMPHIS MAY 11 TO 14

WE WILL SEE YOU IN MEMPHIS
AND RENEW OLD FRIENDSHIPS

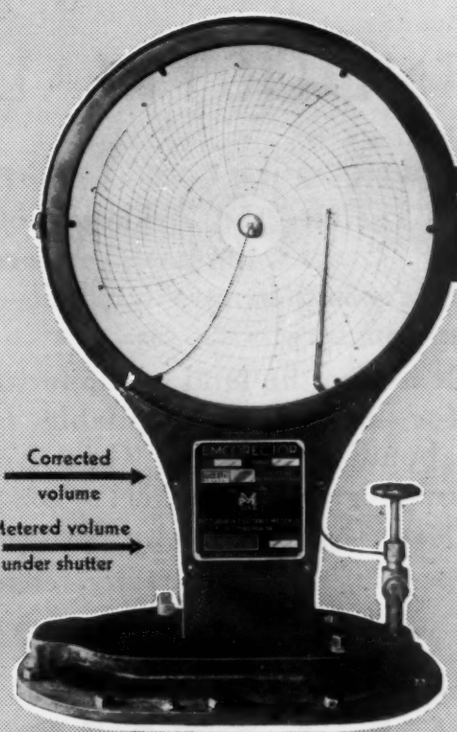
New Orleans Public Service Inc.

Are Your High Pressure Positive Meters Direct Reading?

They are if Equipped with the EMCORECTOR

The EMCORECTOR replaces the conventional pressure and volume gauge as generally used on high pressure meters. It gives a DIRECT READING of VOLUME CORRECTED to any base pressure, regardless of line pressure fluctuations. This eliminates the time and expense involved in making chart calculations.

The correction is made automatically on small increments, thus obtaining an accuracy not possible under the chart observation method of correction.



PITTSBURGH EQUITABLE METER CO.

Main Offices and Factories—PITTSBURGH, PA.

New York Tulsa Columbia Seattle
Chicago Dallas Salt Lake City Houston
Los Angeles Davenport Kansas City

EMCO

. . . . dependable labor +
abundant Natural Gas +
a mighty virgin market =

INDUSTRIAL OPPORTUNITY

THIS is the Louisiana of Evangeline, the Arkansas of the Ozarks, the East Texas of untold wealth in new-found oil—land of romance!

It is also the land of Opportunity, for here are dependable labor, abundant Natural Gas and a mighty virgin market!

Here are a friendly, prosperous people, millions strong, eager to build manufacturing resources. The same splendid transportation facilities that enable the North and the East to ship in finished products are equally ready to solve the local manufacturer's distribution problem.

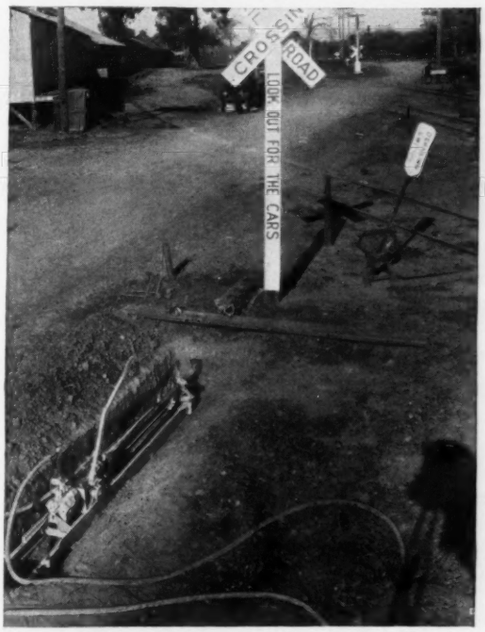
Private interests may expect our cooperation in any enterprise calculated to develop this great area industrially or otherwise.

ARKANSAS NATURAL GAS CORPORATION

A Cities Service Unit

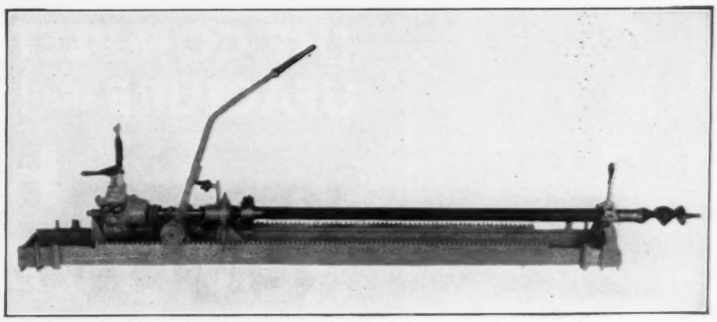
HYDRAUGER *Saves Money*

This remarkable new earth-boring tool, bringing great economies, marks a revolutionary advance in public utility construction.



Hydrauger in use—boring horizontally under three railroad tracks—a distance of more than 100 feet. The end of the bore is where the workman is standing.

This hydraulic auger operates with astounding speed and precision, boring a clean, straight hole. It eliminates virtually all of the tearing up of pavement formerly necessary.



BORING COSTS with Hydrauger are normally **less than one-tenth** the total cost of cutting pavement, trenching, backfilling and replacing pavement. Use of this ingenious new device for boring under streets, highways, sidewalks, buildings and gardens avoids pavement cutting almost entirely. Thus it means **vast savings** in the laying of pipe, condulets and drains.

Operating at remarkable speed, and requiring only two men to handle it, Hydrauger is most practical. The small initial investment is quickly made up by the large operating economies effected.

Can you **afford** to be without Hydrauger?

Send for illustrated leaflet and operating cost analysis, showing savings brought about by Hydrauger, in comparison with former methods.

HYDRAUGER CORPORATION, LTD.

1298 Bryant Street, San Francisco, California

Be Sure to Include
HYDRAUGER
In Your Equipment List
for 1931

Distributors for
Southern California
PACIFIC PIPE & SUPPLY CO.
Santa Fe Avenue at 8th Street
LOS ANGELES, CALIFORNIA

JACKSON

ANNOUNCING

THE COMPLETE DESIGN, MANUFACTURE and INSTALLATION OF H_2S REMOVAL PLANTS

UNDER AGREEMENT WITH THE GIRDLER CORPORATION, Inc., Louisville, Ky.

The Girdler Absorption Process* economically removes H_2S from gaseous mixtures.

The process is particularly applicable to the purification of gases of high H_2S content under pressure, such as NATURAL GAS and REFINERY VAPORS.

Ethanolamine used as absorbent — non-inflammable, highly absorbent and long lived, non-corrosive to ferrous metals.

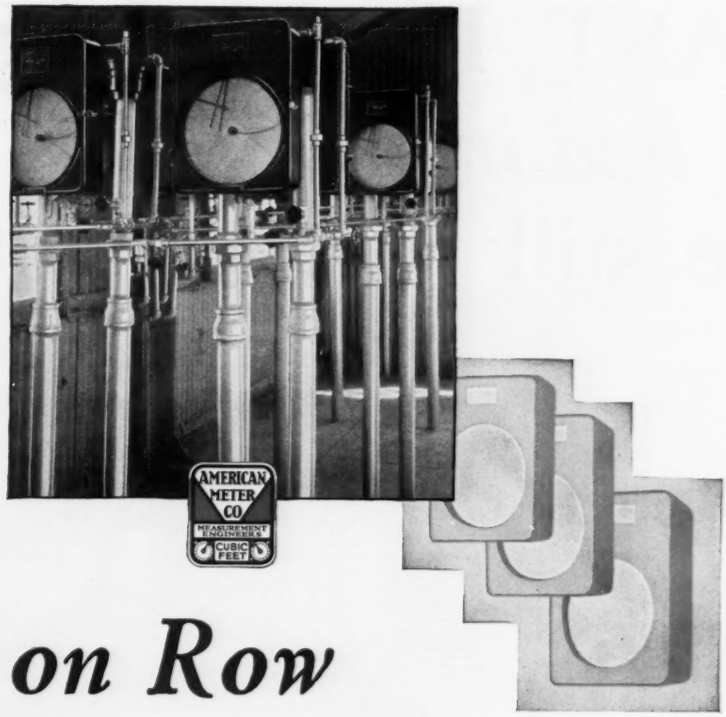
The process is offered under guarantee based upon months of successful operation.

Quotations furnisned upon advice of gas quantity, pressure and an analysis of the gas . . .

*The Girdler Process, covering the use of Ethanolamine and other reagents for the removal of H_2S is both broadly and specifically protected by U. S. Letters Patent No. 1,783,901 and other U. S. and foreign letters patent, both allowed and pending, owned solely by the Girdler Corp. and licensed to the Jackson Engineering Corp. Tulsa, for manufacture and sublicense.

JACKSON ENGINEERING CORPORATION
TULSA, OKLAHOMA

NEW YORK DALLAS TULSA LOS ANGELES



Interior view showing one of two Westcott Orifice Meter settings in a Louisiana station of the Southern Natural Gas Company.

Row on Row of Reliable Records

Less than twenty years ago no Gas Company's financial executive or customer would have accepted the records of an Orifice Meter. Then it was merely an interesting laboratory apparatus.

Today millions of cubic feet of gas are bought and paid for on the authority of tens of thousands of Westcott Orifice Meters. The absolute reliability of the Westcott Orifice Meter is universally recognized and this instrument is writing a new chapter in the annals of the Gas Industry.

New and practical methods for utilizing the orifice for measurement are constantly being investigated and tested in our Erie laboratory.

Complete information is always available on Westcott Orifice Meters, Rate Volume Controllers, Indicating Flow Meters, Liquid Level Recorders and Metric Ironcase Meters.

AMERICAN METER COMPANY
INCORPORATED

The World's Largest Manufacturers of Gas Meters and Allied Apparatus
ESTABLISHED 1836

GENERAL OFFICES : 105 W.40TH STREET · NEW YORK, N.Y.

SALES · ERIE · HOUSTON · DALLAS · TULSA · DENVER · LOS ANGELES · SAN FRANCISCO · ALBANY · BOSTON
SERVICE · PITTSBURGH · CHICAGO · PHILADELPHIA · NEW YORK · BALTIMORE · KANSAS CITY · BIRMINGHAM

CAST IRON GAS MAINS *laid in* BOSTON *in* 1836 are still in excellent condition

The early records of the Boston Consolidated Gas Company inform us that back in 1836 their engineers specified cast iron pipe for gas mains. Today—95 years later—certain of those ancient mains are still on the job and in good condition. Of course, some of the earliest cast iron gas mains have been removed from time to time, not because they were worn out, but due to street construction, re-routing and the need of greater capacity. However, in Boston today there are cast iron gas mains which were laid in 1836 and are still giving excellent service.

No wonder engineers prefer to specify modern cast iron gas mains for *modern* conditions. Notwithstanding the extraordinary service records which old cast iron mains have established, the cast iron pipe produced today is even better.

Modern cast iron pipe is scientifically produced by improved methods and equipment. The quality of the iron itself is improved as to uniformity by the development of laboratory control. And, of course, today's cast iron pipe is designed to serve under far different pressure conditions than would be possible for old-fashioned pipe to meet.

Engineers, contractors and city officials desiring information regarding cast iron pipe for gas, water or sewer mains are invited to write to Thomas F. Wolfe, Research Engineer, The Cast Iron Pipe Research Association, 309 Peoples Gas Building, Chicago, Ill.

Efficient mechanical joints for cast iron gas mains are now in use and obtainable for high-pressure gas distribution.

CAST IRON PIPE

Cast iron pipe bearing the "Q-check" trademark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.;

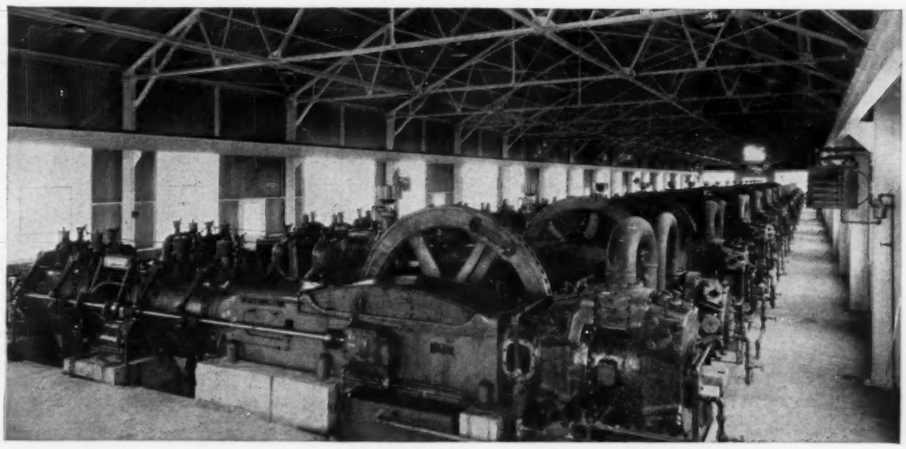
Reg. Trade Mark

CAST Q IRON

The "Q-check" symbol shown above has been adopted as the trademark of The Cast Iron Pipe Research Association.

Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Company, 11 Broadway, New York.

The *largest* booster station ever built *for gas transportation*



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THE new Grayco Station of the Phillips Natural Gas Company in Gray County, Texas, just completed, is the largest booster station for gas transportation in the world. We share with Phillips a pride in this accomplishment, for the installation consists exclusively of Worthington Gas Engine Compressors. ¶Sixteen twin-tandem double-acting engine units, each of 750 horsepower, make up this 12,000 hp. station, designed to compress 68,000,000 cu. ft. of gas daily. ¶In each of these units, two power cylinders in tandem, with a compressor cylinder in line, are twinned, with a single flywheel and a control column between. With this twin-tandem arrangement, each unit takes up a minimum amount of space for the power developed, cutting down the over-all size of the building required. The total foundation and piping connection work for the complete installation was reduced to far less than would have been required with any other form of layout. ¶Consequently the cost of installation of this large station has not been much greater than that of many smaller existing stations. ¶These Worthington Gas Engine Compressor Units are completely described in Bulletin No. S-550-B1A. *May we send you a copy?*

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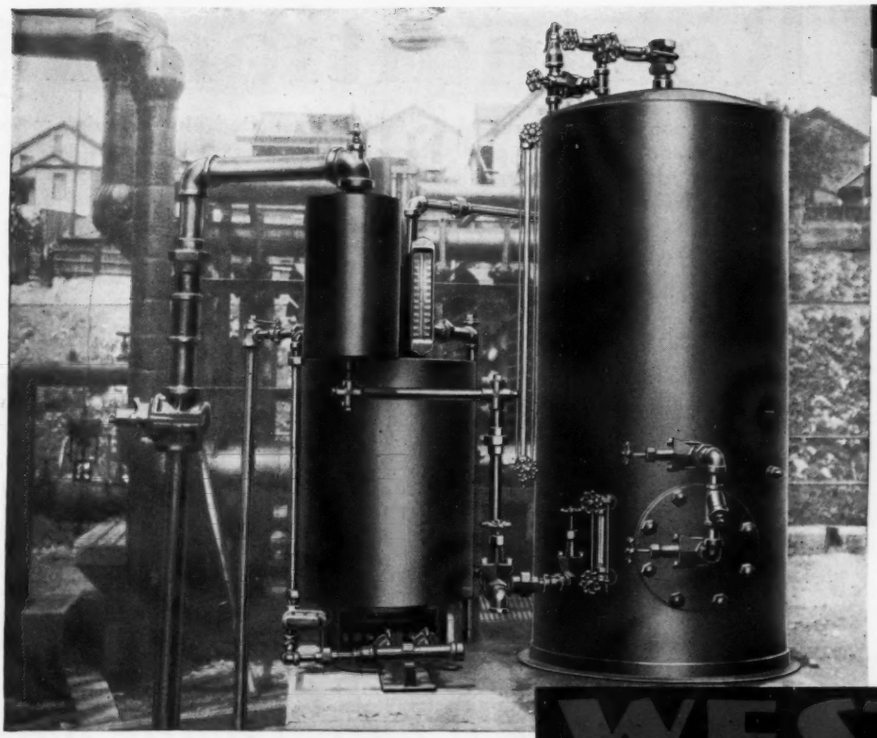

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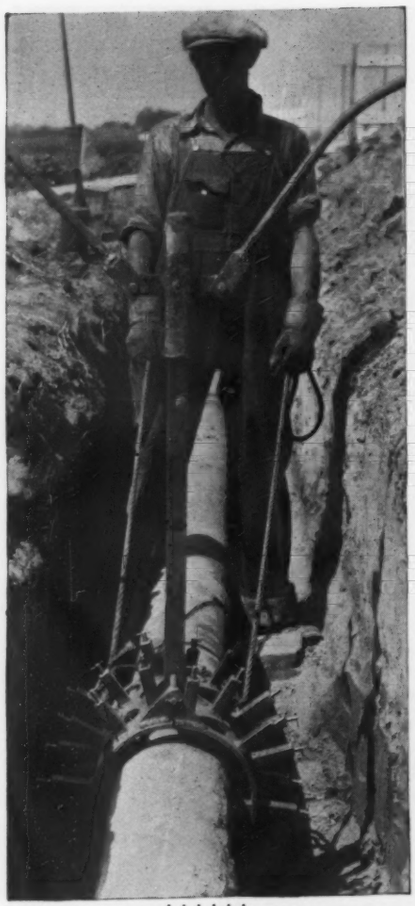

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Mr. S. B. Daugherty

WE HAVE still further strengthened our organization, particularily in the engineering division, by placing Mr. S. B. Daugherty in full charge of our development and research work.

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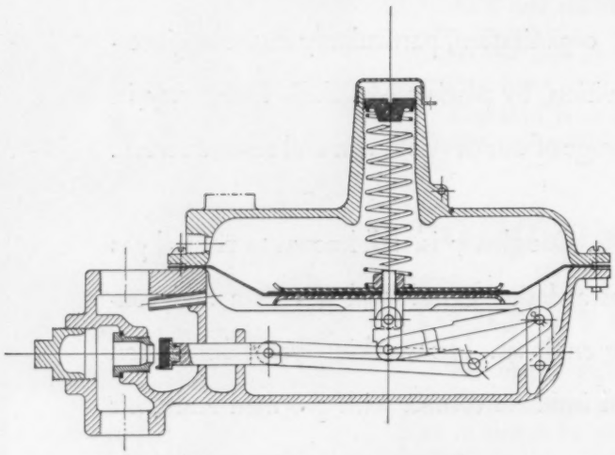

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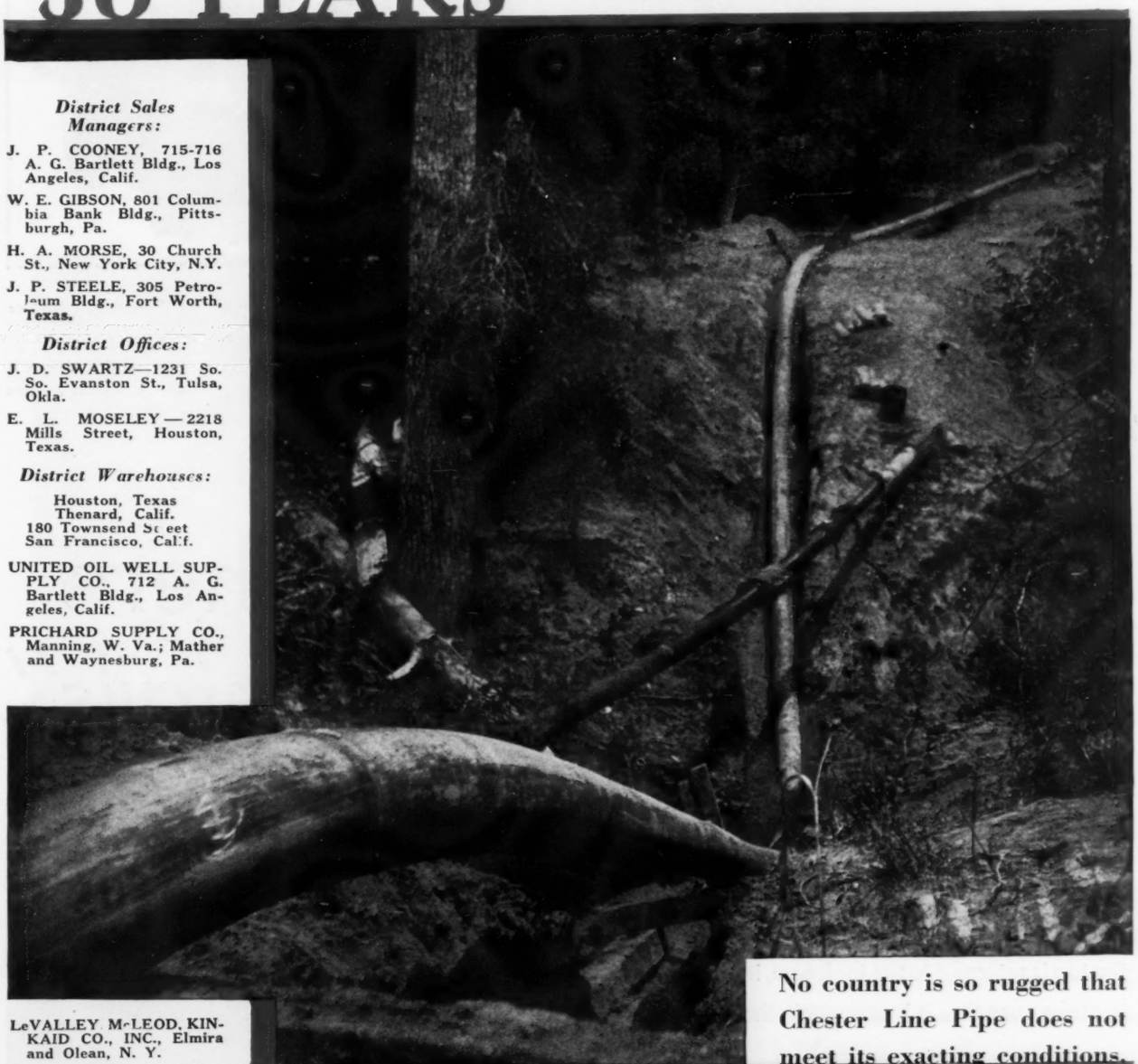

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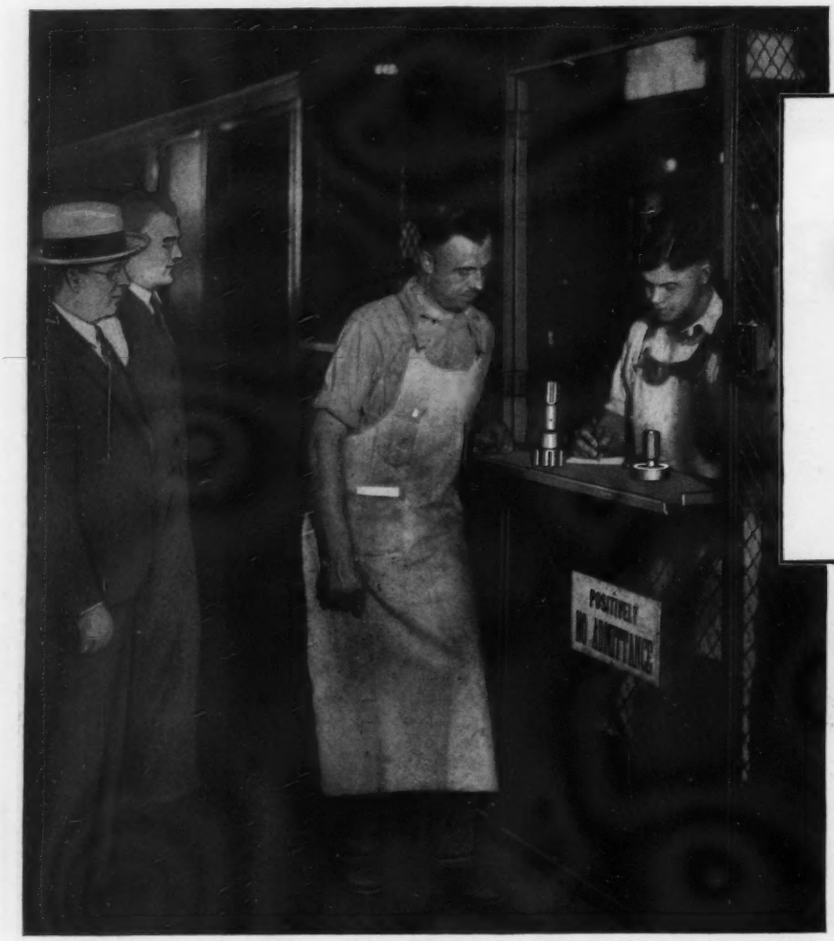

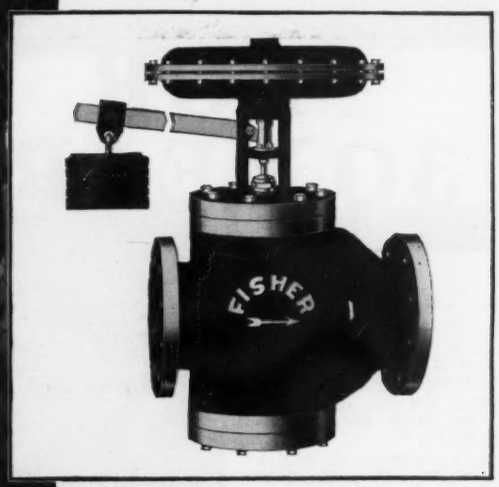

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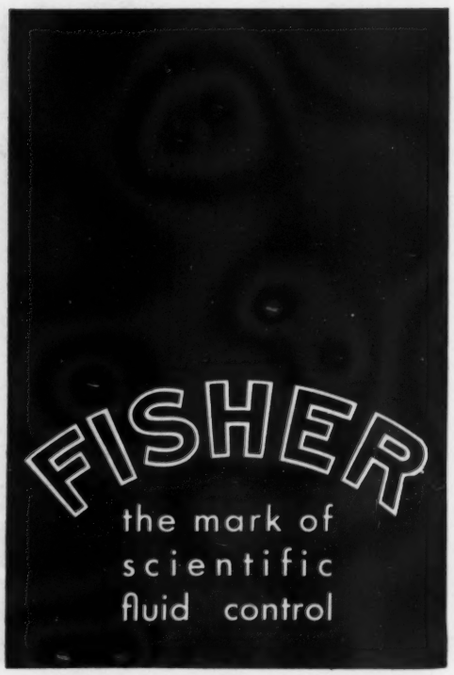

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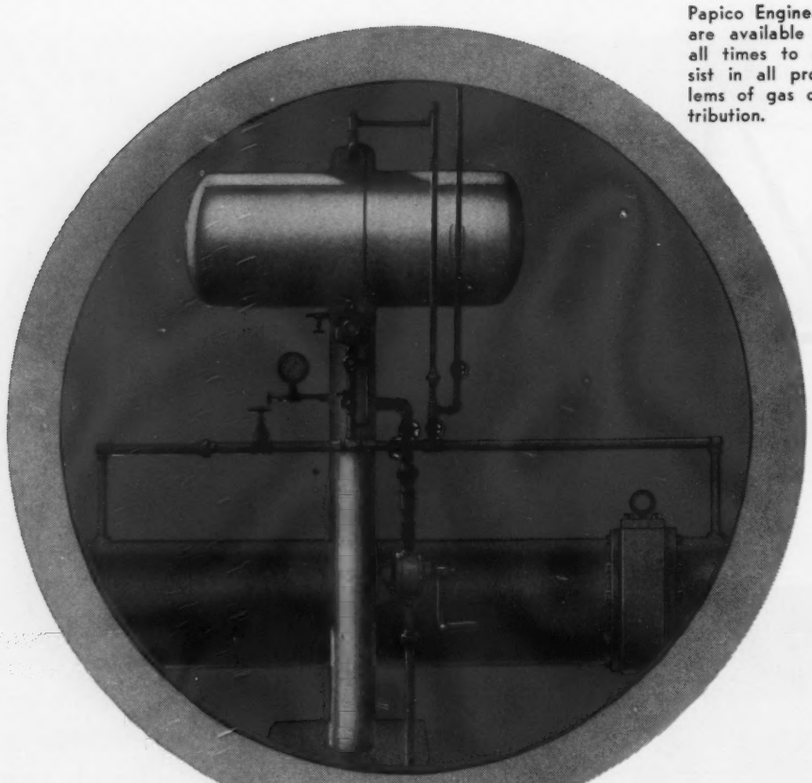

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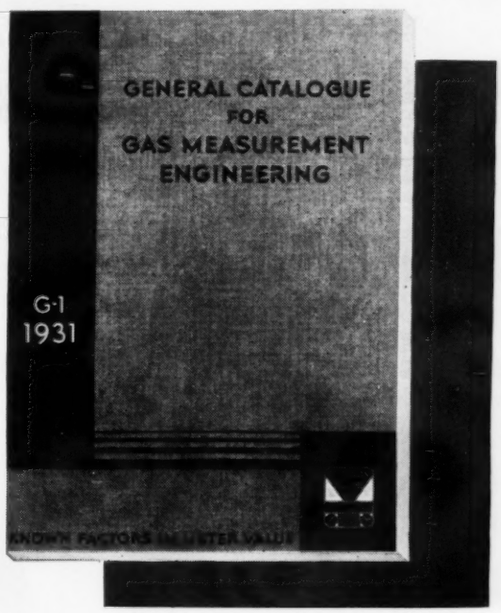

CATALOGUE G-1, 1931 is more than an ordinary catalogue. It does serve as an index to American Meter Company's complete line of products. But its usefulness does not end there.

Catalogue G-1, 1931 is purposely designed for comprehensive reference. Its 220 pages contain much information on gas measurement engineering that can not be obtained elsewhere. It adequately describes each product, and serves both as a guide in purchasing and as a reference to the vast amount of additional operating information and data that is available from American Meter Company.

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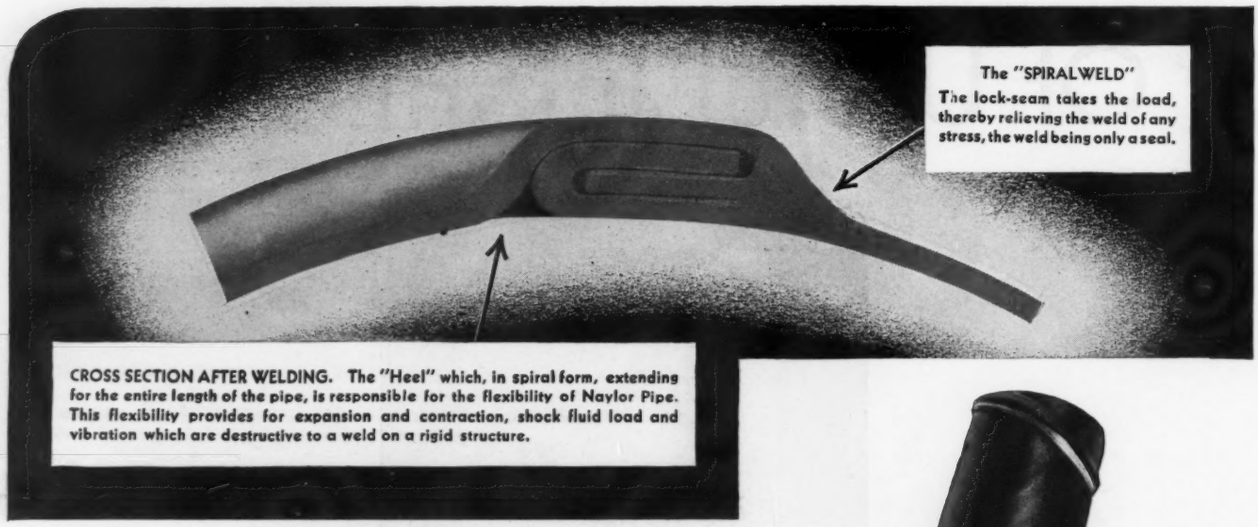

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SAN FRANCISCO: 447 Sutter St.
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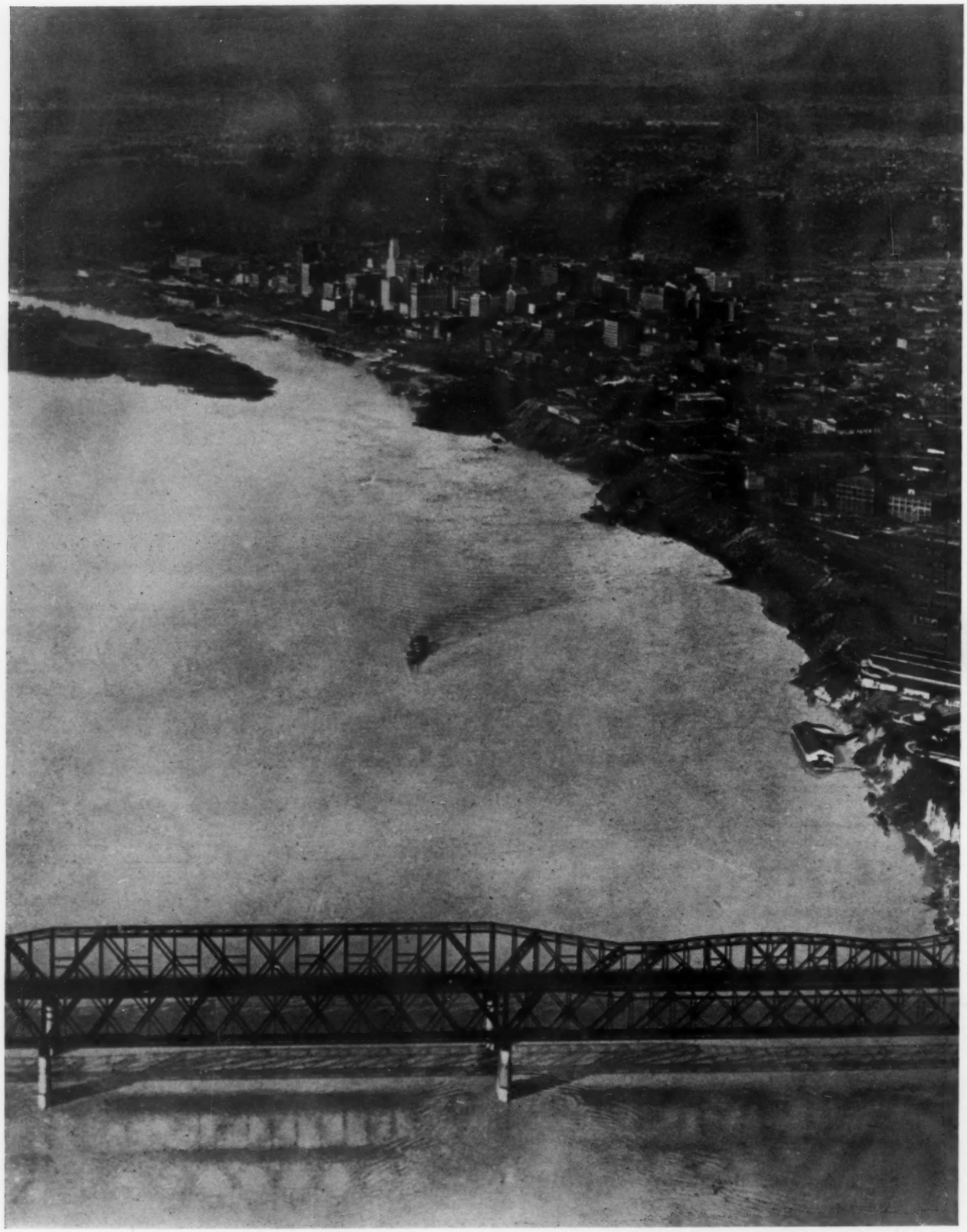
WESTERN GAS is published by Western Business Papers, Inc., at 124 West Fourth Street, Los Angeles. Subscription price (in advance) 20 cents the copy; $2.00 per year; 3 years $5.00; $3.00 per year foreign. Entered as second-class matter June 1, 1925, at the postoffice at Los Angeles, California, under the Act of March 3, 1879. Copyright, 1931, by Western Business Papers, Inc.



AS the airman sees the Natural Gas Department Convention City, from above the harbor. Memphis-on-the-Mississippi — modern natural gas metropolis — holds forth a Southern welcome to the industry during convention dates, May 11-14.

May, 1931

WESTERN GAS

Vol. VII, No. 5

"Reg. U. S. Pat. Off."

A Monthly Journal of the Gas and Gas Appliance Industries in *Western America*

Memphis: Natural Gas Mecca

By W. J. O'BRIEN

Vice-President and General Manager Memphis Power & Light Company.

Chairman General Arrangements A. G. A. Natural Gas Department Annual Convention

THIS year's convention city is a comparative newcomer among the nation's natural gas centers, but during the two years that natural gas has been available the Memphis Power & Light Co. has gone about load-building with an initiative which is an example for the industry to follow. Memphis gas consumption has been boosted some two and one-half times in that period.

Mr. O'Brien, who is vice-president and general manager of the Memphis Power & Light Co., and official host to the Convention in his capacity as chairman of the general arrangements committee, accomplishes two purposes in this message which introduces *Western Gas'* annual Natural Gas Edition. He issues a cordial invitation and welcome to those of the industry who will soon be gathered in convention; and he points out for their attention and interest the salient features of natural gas use in Memphis, reviewing organization methods which have enabled the company to make such a noteworthy showing in load development.—*Editor.*

MEMPHIS counts itself fortunate in being the convention city for the Natural Gas Department of the American Gas Association this year. On behalf of our company it is a pleasure to extend a sincere invitation to the industry to visit our city, and attend the convention.

We feel sure that we will all profit by having in our midst this gathering of leaders in the industry; and, as our company has now been distributing natural gas for a bit more than two years, there will be opportunity for the visitors to observe our system for the benefit it may be to them, in addition to the greater privileges the convention activities afford.

Natural gas was introduced into Memphis the first of January, 1929. Our supply is drawn from the Monroe fields in Louisiana. A pipe line, 210 miles in length, owned and operated by the Memphis Natural Gas Co., supplies us. The line is 18 inches in diameter, and, being operated at about 300 pounds pressure, has a capacity of approximately 60 million cubic feet delivery per day. The gas is delivered at the city gate by the pipe line company to the Memphis Power & Light Co. for distribution.

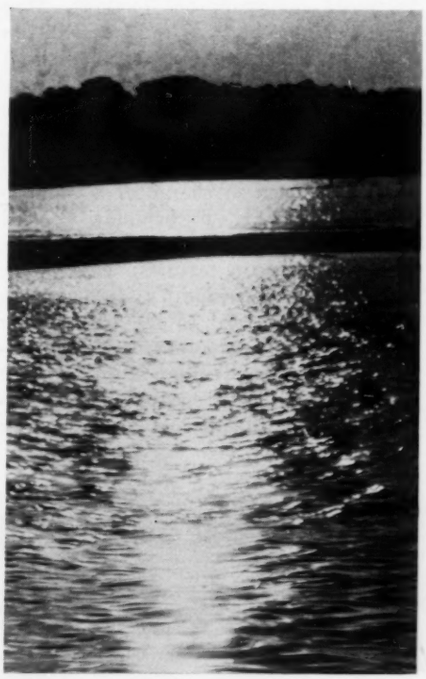
In preparation for the introduction of natural gas, the Memphis Power & Light Co. overhauled its high pressure mains. In addition, a 16-inch welded steel high pressure main, for serving the commercial area of the city, and a new 18-inch welded steel belt line for serving newly annexed territory have been laid.

Gas is received from the pipe line company at the city gate metering station located south of the city, and transmitted through a 22-inch welded steel main 4 miles in length, to the main gas distributing station. There the pressure is reduced through regulators into an intermediate pressure belt line for transmission through the city. Industrial and large commercial customers are supplied directly from this belt line and its branches, while a number of district regulators at suitable locations feed gas into the low pressure network.

Prior to the introduction of natural gas, the Memphis Power & Light Co. was distributing manufactured gas. It is interesting to note that the first gas plant serving Memphis was put into operation in 1852.

During the period of about 28 months since the time of introduction, the consumption has increased constantly until now the average daily output approxi-

(Continued on Page 102)



Memphis may be the "Chicago of the South"—but it doesn't lack in atmosphere, as demonstrated by this sunset scene of President's Island across the waters of the Mississippi

H. C. Cooper
Natural Gas Dept.
Chairman

H. L. Montgomery
Department
Vice-Chairman

E. J. Stephany
Department
Secretary

Alexander Forward
A.G.A. Managing
Director

W. J. O'Brien
Arrangements
Chairman

E. F. Schmidt
Program
Chairman

Convention Curtain Rises May 11

DURING the past weeks A.G.A. Natural Gas Department heads and committee workers have been setting the stage for another of the conferences which each year bring together representatives of the natural industry's widely distributed units. As the Natural Gas Edition of *Western Gas* goes to press convention dates are close at hand —May 11 to 14—and Memphis, Tennessee, will soon extend its welcome to the annual convention.

On another page of this issue W. J. O'Brien, chairman of arrangements for the Memphis meetings, and vice-president and general manager for the Memphis Power & Light Co., conveys an invitation to the industry on behalf of his company and of his city. Memphis' experience with natural gas has been brief but extremely active, and convention-goers will have at hand the examples of a company which has capitalized its market opportunities to a high degree. Mr. O'Brien gives something of his company's experience in market development in his article which opens this issue.

In another section, D. C. Shaffer, vice president and general manager of the Memphis Natural Gas Gas Co., briefly reviews the enterprise which brought natural gas to Memphis, and tells of his company's present expansion program.

Natural gas is playing a leading role in the industrial progress of Memphis since its introduction a little more than two years ago. As the "Chicago of the South," center of a great inland cotton market and a steel industry of considerable magnitude, the convention city offers natural gas men an unusual mixture of the "old south" and twentieth century progress.

Monday, May 11, is given over to registration, and to meetings of the Main Technical and Research Committees and sub-committees, and of Managing and Advisory Committees of the Department.

The first of five general sessions will be called to order by H. C. Cooper, Department chairman, on Tuesday, May 12. Meetings at 9:30 and at 2:00 on Tuesday, morning and afternoon sessions on Wednesday, and a morning symposium on production, Thursday, comprise the general session schedule.

Program details for the Memphis sessions have been in charge of a committee headed by E. F. Schmidt, general superintendent of the Lone Star Gas Co., Dallas. Program features, which were set forth in last month's issue, give a large place this year to gas development phases. Two symposiums have been arranged—one on drilling and the other on production, with speakers from Eastern, Mid-Continent, and Pacific Coast sections to reflect trends in practice throughout the country. Sales and utilization topics are also given prominence, and as is always the case, there are a number of able presentations arranged on transmission and distribution practice.

General Arrangements Committee—W. J. O'Brien, chairman, Memphis, Tenn.; B. C. Adams, Kansas City, Mo.; J. B. Corrin, Pittsburgh, Pa.; H. L. Dickerson, Houston, Texas; Edgar G. Hill, New York City, N. Y.; Alfred Hurlburt, Chicago, Ill.; William Moeller, Jr., Los Angeles, Calif.; J. R. Munce, Shreveport, La.; F. F. Schauer, Pittsburgh, Pa.; D. C. Shaffer, Memphis, Tenn., and T. R. Weymouth, New York, N. Y.

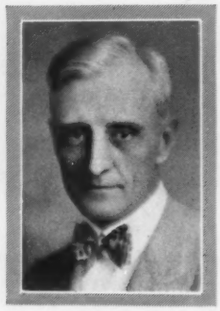
Program Committee—E. F. Schmidt, chairman, Dallas, Texas; W. A. Dunkley, Memphis, Tenn.; L. Fitzpatrick, Salt Lake City, Utah; T. H. Kerr, Columbus, Ohio; J. H. Maxon, Omaha, Neb.; A. E. Merchant, New Orleans, La.; H. L. Montgomery, Bartlesville, Okla.; W. B. Trammell, Houston, Texas, George Wehrle, Denver, Colo., and W. S. Yard, San Francisco, Calif.

Publicity Committee—Paul Renshaw, chairman, Memphis, Tenn.; J. C. Barnes, New Orleans, La.; William C. Grant, Dallas, Texas; C. D. Greason, Kansas City, Mo., and R. S. McBeth, Tulsa, Okla.

Hotels Committee—J. J. Brennan, chairman, Memphis, Tenn.

Reception Committee—W. N. Ford, chairman, Memphis, Tenn.

J. J. Brennan
Hotels



Paul Renshaw
Publicity

W. N. Ford
Reception

1930-1931 *in* Gas Transmission Line Construction

By CRAIG ESPY
Eastern Manager, Western Gas

FOLLOWING its custom of the past several years, *Western Gas* in the Natural Gas Edition presents to its readers a review of transmission line construction in Western America, the current survey covering the period of 1930-1931 and the year 1931 to date.

Pushing forward in a year of general industrial depression, as a result of the growing demand for natural gas service in practically all large population centers, gas transmission construction more than maintained the momentum set up during the boom year of 1929, entering the current year with an enviable record of progress.

Individual company returns in hand show a total of 6,186.91 miles of gas transmission line constructed during 1930, as compared with the last year's survey total of 5,756.61. Lines laid to date in 1931 or under construction at this time total 3,530.4, the comparable figure from last year's survey being 1,263.25. In addition to these lines completed or in progress, company returns show a total of 3,033.35 miles definitely proposed, with construction assured for the immediate future. These totals are built up on actual returns from companies taking part in this construction program, and does not include lines which are indefinitely proposed, or rumored.

The information contained in the tables accompanying this running review of pipe line construction are made possible through the splendid cooperation of the companies represented therein, and gives a cross section of the progress of the industry during the period covered. In most cases, these companies have also supplied maps of their transmission line systems, the lines being charted on the large map accompanying this edition of *Western Gas*, and giving a comprehensive picture of transmission line progress in Western America during 1930-31. Only definitely projected lines are shown as such on this map.

Along with the laying of transmission lines, another construction phase has shown a healthy growth. A score of these reporting companies have completed approximately 40 compressor stations with a total installed capacity of more than 170,000 B.H.P. One of these companies — Continental Construction, laying the line from Texas fields to Chicago—has built 10 compressor stations of 6,250 B.H.P. each—a total of 71,250, with another to be constructed soon near Chicago. A table showing compressor plant construction during 1930-1931 will appear in the June issue of this publication.

As a result of the construction of approximately 6,000 miles of gas carriers in 1930, towns to the number of 400 or more received gas that year for the first time. This applies particularly to the middle west where much territory was pioneered by interstate carriers. In addition to this, service was begun in 1931 in approximately 100 more communities, and is scheduled for an additional hundred on the basis of franchise applications now granted. Details of this expansion are shown in a New Gas Service Area survey, beginning on page 58 of this issue.

Change-over programs in many cities of the west have also been an important result of construction activity. Among these have been San Francisco, Sacramento, Watsonville, Santa Cruz, and Stockton, Calif.; Albuquerque, N. M.; Lincoln, Neb.; Springfield and Sedalia, Mo.; and Council Bluffs, Iowa. Other cities now in line for natural gas service are Sioux City, and Des Moines, Iowa; Omaha, Neb.; St. Louis, Mo.; and Joliet and Chicago, Ill.

Highlights of natural gas transmission line construction, as shown in the survey, are presented in the following pages.

GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
***MAJOR INTERSTATE LINES**					
Continental Construction Co.	Fritch, Texas to Joliet, Ill.	480 162 258	24 24 24	Completed, 1930 Completed, 1931 In progress	....
Continental Construction Co.	Gray County, Texas to Fritch, Texas	39	24	Completed, 1931	.....
Continental Construction Co.	Moore Co., Texas to Fritch, Texas	39	24	Completed, 1931	.....
Continental Construction Co.	Joliet, Ill., to Chicago	80	24	In progress	.....
Drumheller Interests	Cut Bank field to Spokane, etc.	250	..	Proposed	.....
Missouri Valley Pipe Line Co.	Carson County, Texas to Mullinsville, Kan.	169	24	Completed, 1930	$4,563,000
Missouri Valley Pipe Line Co.	Mullinsville, Kan., to Clifton, Kan.	..	24	Projected	.....
Missouri Valley Pipe Line Co.	Clifton, Kan., to Plattsmouth	132	24	Completed, 1930	3,565,000
Missouri Valley Pipe Line Co.	Plattsmouth to Ogden	120	24	Completed, 1931	3,340,000
Missouri Valley Pipe Line Co.	Ogden, Iowa, to 13 miles west of Mason City	86	20	Completed, 1931	1,903,000
Panhandle Eastern Pipe Line Co.	Amarillo, Texas to Liberal, Kan.	100	24	Completed, 1930	.....
Panhandle Eastern Pipe Line Co.	Liberal to Louisiana, Mo.	600	24	Completed, 1931	.....
Panhandle Eastern Pipe Line Co.	Louisiana, Mo., to Indianapolis, Indiana	300	24	Projected	.....
Western Gas Co.	El Paso, Texas, to Bisbee and Douglas, Ariz., and Cananea, Mexico	8 218 13 40 8 3	16 12¾ 10¾ 8⅝ 6⅝ 4½	In progress	$6,000,000

*This classification includes only company developments extending into three or more states.

The year 1930-1931 has seen the spanning and re-spanning of a thousand miles of territory in the Mid-Continent Mid-West area, with completion of three large-diameter lines from the Texas Panhandle to markets in Nebraska, Iowa, Missouri, Kansas and Illinois.

MID CONTINENT-MID WEST AREA

Continental Construction Co., has brought to completion the section of its 24-inch, 1,058-mile Amarillo-Chicago carrier from the line's source to Muscatine, Ill., with contracts let for completion from that point to Chicago. Extensions of this line are projected to Minneapolis and St. Paul, Minn.; Milwaukee, Wis.; Springfield, Ill.; Indianapolis, Ind.; Detroit, Mich.; and to Toledo, Ohio. The Chicago market however, is the immediate aim, with service expected to begin in the second largest city of the United States by mid-summer. A change-over program of gigantic proportions will get under way with the completion of the line, the gas to be distributed there by Peoples Gas Light and Coke Co. The line will be operated by the Natural Gas Co. of America, jointly owned by Cities Service Co., Insull Son & Co., Southwestern Development Co., Standard Oil Co. of New Jersey, the Texas Co.; Skelly Oil Co., Phillips Petroleum Co., and the Columbian Carbon Co. Gas supplies controlled by the interested companies are said to be in excess of seven trillion feet, and more than 50 cities and towns will find natural gas available through this carrier. Cost of the development is estimated at $100,000,000. Ten compressors with a total of 71,250 B. H. P. have been installed on the Fritch-Joliet section, while between Joliet and Chicago, a 6,250 B.H.P. compressor station is being constructed.

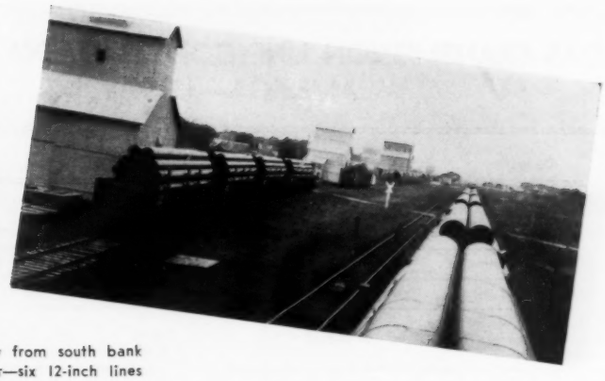
Missouri Valley Pipe Line Co., constructing an 808-mile line from Carson County, Texas, to metropolitan markets in Nebraska and Iowa, announced completion of 512 miles of its line in 1930, with an additional 296 miles completed in 1931. A large portion of this carrier was constructed of 24-inch pipe, with laterals serving over 40 cities and towns in Iowa and Nebraska, among them Council Bluffs, Iowa and Lincoln, Neb., with Mason City and Fort Dodge scheduled for natural gas shortly. A 20-inch lateral from this line passes within a short distance of Omaha, where franchise applications are pending, to Sioux City, where natural gas is now available for industries and the domestic market. Franchise details have not been settled in that town, but the pipe line has been constructed to the city gate. Plans of this company for extension of its main line include a 20-inch carrier from Mason City to Indianapolis and St. Paul, and a lateral to Des Moines.

An important factor in the taking of Texas gas to Iowa and Nebraska centers by Missouri Valley Pipe Line Co., has been the tying in of Kansas Pipe Line & Gas Co's. system at Clifton, Kan., and at Mullinsville, Kan., postponing the construction of a line between these two points on the route of the Missouri Valley line. This unit will be constructed eventually, but for the present time gas from the Panhandle is routed through the Missouri Valley Co's. 24-inch carrier to Mullinsville, where a tie-in is made with Kansas Pipe Line & Gas Co's. lateral extending from the Barber County-Hutchinson line. From this point the gas is taken through Kansas Pipe Line's system to Clifton, where Missouri Valley's 24-inch line takes it on to its final destination in the several cities named above. Two compressors, one of 5,000 and one 3,000 B.H.P. have been completed by Missouri Valley Pipe Line Co. on the main line. Cost of the entire project is estimated at $17,674,500.

Panhandle Eastern Pipe Line Co.: Late in May, 1930, announcement was made by the Missouri-Kansas Pipe Line Co., that contracts had been let for portions of its 24-inch line from Moore County, Texas, to markets in Kansas, Missouri, Illinois, and Indiana. In April, 1931, completion of the line to the Missouri-Illinois State border was announced, with contracts let on the section lying east of the Mississippi River. Cost of the 1,000-mile carrier

GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

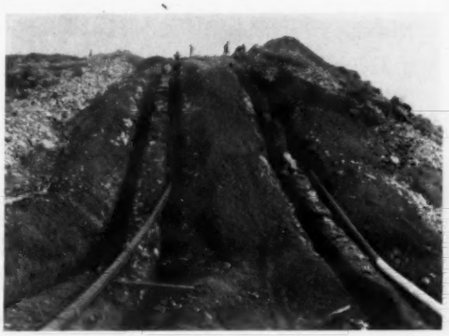
Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
ARKANSAS					
Arkansas Western Gas Co.	Clarksville gas field to Fayetteville	86.35	8, 6 and 4	Completed, 1930	.....
Arkansas Western Gas Co.	Fayetteville to Siloam Springs	24.5	5	Completed, 1930	.....
Arkansas Natural Gas Corp.	Pinebluff to Mississippi River Fuel Corp.	1	6	Completed, 1931	.....
Memphis Natural Gas Co.	From main line to Helena, Mariana, Forest City, Wynne, Brinkley and Augusta line	100	10, 8 and 6	Proposed	.....
CALIFORNIA					
Coast Counties Gas & Electric Co.	Dos Palos to South Dos Palos	2.151	2	Completed, 1930	5,300
Coast Counties Gas & Electric Co.	Walnut Creek to Danville	6.061	4	In progress	22,900
Coast Natural Gas Co.	Stanpac line to Firebaugh	13	3 and 4	Completed, 1930	57,000
Coast Natural Gas Co.	Stanpac line to Dos Palos	12	3 and 4	Completed, 1930	54,000
Coast Natural Gas Co.	Stanpac line to Los Banos	8	3 and 4	Completed, 1930	28,000
Coast Natural Gas Co.	Stanpac line to Brentwood	2	3 and 4	Completed, 1930	8,000
Pacific Gas & Electric Co.	Standard Pacific line to Tracy	6	4	Completed, 1930	27,000
Pacific Gas & Electric Co.	Manteca to Modesto	21.54	8	Completed, 1930	203,000
Pacific Gas & Electric Co.	Standard Pacific line to Holly Sugar Refinery near Tracy	8.13	6	Completed, 1930	49,000
Pacific Gas & Electric Co.	Modesto to Turlock	14.46	6 and 8	Completed, 1930	101,000
Pacific Gas & Electric Co.	Standard Pacific line to Newman	5.85	8	Completed, 1930	51,000
Pacific Gas & Electric Co.	Modesto to Riverbank	5.23	6	Completed, 1930	33,000
Pacific Gas & Electric Co.	Riverbank to Oakdale	5.72	4	Completed, 1930	24,000
Pacific Gas & Electric Co.	Thornton to Galt	7.14	4	Completed, 1930	57,000
Pacific Gas & Electric Co.	Napa to Calistoga	46.31	8, 6 and 4	Completed, 1930	357,000
Pacific Gas & Electric Co.	Schellville to Glen Ellen	12.02	6	Completed, 1931	91,000
Pacific Gas & Electric Co.	Hollister to Monterey	23.51 19.7	12 8	Completed, 1930	588,000
Pacific Gas & Electric Co.	Easton to Sanger	11.67 5.45	6 4	Completed, 1930	93,000
Pacific Gas & Electric Co.	Davis to Dixon	9.84	6	Completed, 1930	61,000
Pacific Gas & Electric Co.	Vernalis to Sacramento	74.82	16	Completed, 1930	1,644,000



UPPER LEFT: View from south bank of Republican River—six 12-inch lines entering crossing.

UPPER RIGHT: 24-inch pipe on cars—Farnsworth, Texas, siding.

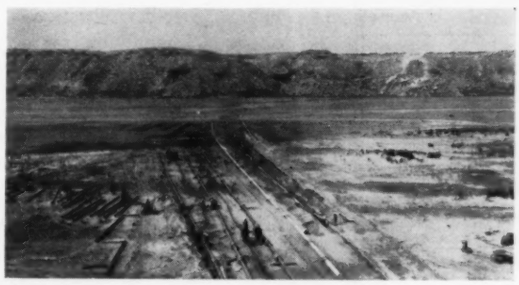
BELOW: Lowering operations in progress.



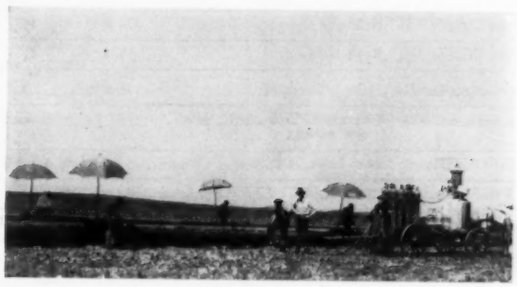
ABOVE: Four ditches under way —north bank Canadian River.

ABOVE: 12—24-in. header—South bank of Pawnee River.

BELOW: Canadian River from south bank—12-inch lines.



BELOW: Welding operations. Acetylene generator at right.



Continental Construction Corp. Operations on Texas-Chicago line—Seen in Picture

was estimated at $40,000,000. The line has been constructed as far as Louisiana, Mo., by Panhandle-Eastern Pipe Line Co., an organization formed as a result of Missouri-Kansas Pipe Line Co. and Columbia Oil & Gasoline Co. (subsidiary of Columbia Gas and Electric Co.) becoming affiliated in this important project. In an account beginning on page 50 of this issue, A. Faison Dixon, of Brokaw, Dixon, Garner & McKee, reviews engineering phases of the Panhandle-Eastern line in comprehensive and interesting style.

Approximately 25 laterals are either completed or under construction from the main line, serving, among others, Jefferson City, Moberly, Bowling Green, Mexico and Louisiana, Mo.

OTHER INTERSTATE CARRIERS

Western Gas Co.: The past year saw the formation of plans by Western Gas Co. of El Paso, Texas, for a 12-inch line to take gas from the Lea County field in New Mexico to mining centers in Arizona, as well as giving domestic service to communities enroute. Construction is now well under way, with 115-miles of the line announced as complete late in April. Leaving El Paso Natural's carrier, the 290-mile line will traverse some of the most rugged terrain of New Mexico's Rockies, passing near Deming and Rodeo, and finding its terminus in smelters at Douglas and

GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
CALIFORNIA (Continued)					
Pacific Gas & Electric Co.	Vallejo to Petaluma	33.09	12	Completed, 1931	744,000
Pacific Gas & Electric Co.	Tracy to Milpitas	35.93	22	Completed, 1930	1,264,000
Pacific Gas & Electric Co. for San Joaquin Light & Power Corp.	Fresno to Merced	6.73 51.99	12 8	Completed, 1931	454,000
Pacific Gas & Electric Co.	Sacramento to Marysville	50	..	Proposed	
San Diego Consolidated Gas & Electric Co.	La Jolla to Carlsbad	25.46	6 and 4	Completed, 1931	190,000
San Diego Consolidated Gas & Electric Co.	Chula Vista to San Ysidro	7.5	4	Proposed	50,000
San Joaquin Light & Power Corp.	Main line to Madera	..	..	In Progress	.....
San Joaquin Light & Power Corp.	Kettleman Compressor Station to to Herndon line	50		Projected	700,000
Southern California Gas Co.	Los Angeles to Lebec	10.22 55.76	26 22	Completed, 1930 Completed, 1930	398,000 1,922,000
Southern California Gas Co.	2.5 miles North of Ventura to Telegraph Road	5.29	16	Completed, 1930	110,000
Southern California Gas Co.	5 miles North of Taft to point 5 miles East of Taft	7.07	22	Completed, 1930	220,500
Southern California Gas Co.	On Sepulveda and Slauson to compressor plant (L. A. City)	9.49	26	Completed, 1930	440,000
Southern Counties Gas Co.	Ventura to Elwood	33.6 3.1	16 12¾	Completed, 1931	684,000
Southern Fuel Co.	Kettleman Hills to Los Angeles and Long Beach	210	26	In Progress	7,000,000 (Estimated)
Standard Pacific Gas Line, Inc.	Kettleman to San Pablo	43.1 9.5 24.8 120.7	22 20 24 26	Completed, 1930	.....
CANADA					
Northwestern Utilities, Ltd.	Holden to Ryley	8.8	12¾	Completed, 1930	116,616
Northwestern Utilities, Ltd.	Ryley to Shonts	7.22	12¾	Proposed	91,450
Colorado Interstate Gas Co.	Pinon to Portland	28	8	Completed, 1931	.....
Colorado Interstate Gas Co.	Sullivan to Fitzsimons Hospital and Aurora	8	8 and 6	Completed, 1930	.....
Colorado Interstate Gas Co.	Loop La Junta to Santa Fe Shops	1.9	4 and 2	Completed, 1930	.....
Colorado Natural Gas Co.	Hugoton fields to Colorado Springs	212	10	Proposed	.....
Colorado Gas and Utilities	Hugoton fields to Lamar and and Springfield	250	8, 6 and 4	Completed	.....
Colorado-Wyoming Gas Co.	Johnston to Greeley	13	6	Completed, 1930	910,000
Colorado-Wyoming Gas Co.	Arvada to Golden	9	4	Completed, 1930	45,000
Colorado-Wyoming Gas Co.	Erie to Brighton	24	3	Proposed	72,000
IDAHO					
Western Public Service Co.	Ogden, Utah, to Pocatello, Idaho	100+		Proposed	3,500,000
Mountain States Oil & Gas Co.	Crystal Dome to Boise, Payette, Weiser, etc.			Proposed	.....
IOWA					
Northwestern Light & Power Co.	Cherokee to Storm Lake	23	4	Proposed	.....
KANSAS					
Arrow Pipe Line Co.	Marion to Peabody	5.5 8.5	5 4	Completed, 1930	51,860
Arrow Pipe Line Co.	Peabody line to Florence	8.5	4	Completed, 1930	28,300
Cities Service Gas Co.	Dilworth, Okla. to Wichita 16 mile line	32	20	Completed	.....
Cities Service Gas Co.	Lawrence to Tonganoxie	10	16	Completed	.....
Cities Service Gas Co.	Holton to Whiting	20	4	Completed	.....

Bisbee, with an extension to serve the mining center of Cananea, Old Mexico. Compania Occidental de Gas will operate the Mexican section of the line. Two compressor stations are being constructed on the El Paso-Douglas line, located at El Paso, Texas, and at Lordsburg, N. M. Two others will be added to the existing line from Lea County field to El Paso, the four having a combined horsepower of 24,750. Cost of the entire project is estimated at $6,000,000.

Arizona Edison Co., Phoenix, is already making preparations looking toward the change-over from manufactured to natural gas at Douglas and Bisbee.

Drumheller Project: Plans to take natural gas to Spokane and possibly Seattle, Wash., as well as towns and cities in Montana and Idaho, have been announced by the Jerome K. Drumheller interests, operating out of the Cut Bank field in northern Montana. It is expected that the route of the line will take it through Glacier and Kalispell, Mont., Wallace, Kellogg, Coeur d' Alene and Post Falls, Idaho. From Coeur d' Alene the carrier would parallel the state highway to Spokane. It is estimated that the line this far will cost approximately $15,000,000. No date has yet been given for beginning construction, but franchising activity is under way.

MID-CONTINENT

The year 1930-31 in the Mid-Continent has seen gas transmission line construction forging steadily ahead, with many individual companies represented in the activity, adding thousands of miles to ever increasing totals.

Cities Service Gas Co.: In September, Cities Service Gas Co. completed its 116-mile line from Lyons, Kan. across the state line to Superior, Neb., this carrier extending service to more than two-score towns in Kansas, as well as to Superior, Neb. From Horton, Kan., the company also constructed a 20-mile line to serve Holton, and from Lawrence, a 10-mile 16-inch line was constructed to Tonganoxie, Kan.

Another major Cities Service extension was the company's 110-mile carrier from the Ottawa, Kan., station, across the state line to Sedalia, Mo., serving a score or more of towns, several of which had been receiving manufactured gas service. At a point near Knobnoster, Mo., an 8-inch lateral leaves the main 12-inch line, serving Carrollton, Lexington, and Marshall, among others. These towns received their first natural gas in February, 1931. Franchising

activity is still going on in this district, and distribution systems are being constructed in several communities, with service scheduled to start late in April or early in May.

Augmenting its gas supply for Kansas and Missouri centers, Cities Service Co. constructed a 98-mile, 20-inch line from the Oklahoma City field to the Dilworth main line, and a 32-mile, 16-inch line from the Dilworth station to the Wichita, Kan., 16-inch carrier. This company in 1930-31 added a total of 25,000 B.H.P. in compressor facilities throughout its system.

As a result of its construction activity, the company in 1930 added 41 towns in Kansas and Missouri to its service area.

Kansas Pipe Line & Gas Co., headquartered at Salina, Kansas, has carried on an active construction program during the year, with 730 miles of line completed in 1930 and 765 miles to date in 1931. Service was extended to 30 towns in Kansas by this company during 1930, with eight more added to date in the current year.

From Hutchinson, Kan., to the state border of Nebraska, a line was completed early in 1930, taking service to several Kansas towns, and extending into Nebraska to serve Grand Island and points enroute. This company, through its subsidiary, the Nebraska Natural Gas Co., pioneered the central Nebraska natural gas market. Since completion of the main line an extension has been constructed to Kearney, Minden, and Holdredge, all in Nebraska. Missouri Valley Pipe Line Co. tied in its 24-inch line with the lines of the Kansas Pipe Line & Gas Co. at Clifton, Kan., and at a point near the Nebraska state line the latter company constructed a 100-mile extension to Seneca, Kan., marketing its gas in several smaller towns on the way.

Completing the tie-in with Missouri Valley Pipe Line Co., Kansas Pipe Line constructed a 64-mile, 18-inch line from Calista, on the Medicine Lodge-Hutchinson line to Mullinsville, where the two lines are joined, facilitating the movement of gas from the Texas Panhandle to Mid-West markets.

Kansas Gas and Gasoline Co., affiliated with Kansas Pipe Line, constructed 73 miles of 16-, 10-, and 8-inch lines during 1930 in the Hutchinson, Halstead and Barber County gas fields, and in 1931 added 85 miles of the same type of construction to the growing totals.

Western Service Corp.: Construction was started early in April on a 50-mile transmission line for Western Service Corp., from a point near Pleasanton, in Kansas, to Deepwater, Mo., with fran-

(Continued on Page 86)

GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
KANSAS (Continued)					
Cities Service Gas Co.	Lyndon to Osage City	9	4	Completed	.....
Cities Service Gas Co.	Oklahoma-Kansas State Line to to Parsons	28.6	8	Completed	.....
Cities Service Gas Co.	Lyons, Kan., to Superior, Neb.	116 49 37 46	8 4 3 2	Completed, 1930	1,557,529
Kansas Pipe Line & Gas Co.	McPherson to Assaria	24.918	6	Completed	.....
Kansas Pipe Line & Gas Co.	McPherson field to Manhattan	82.969	8	Completed	.....
Kansas Pipe Line & Gas Co.	McPherson to Hutchinson	25.226	8	Completed	.....
Kansas Pipe Line & Gas Co.	McPherson field to Salina	25.753	8	Completed	.....
Kansas Pipe Line & Gas Co.	Main Line to Lindsborg	4.143	4	Completed	.....
Kansas Pipe Line & Gas Co.	Elmo to Herington	13.273	4	Completed	.....
Kansas Pipe Line & Gas Co.	Hope to Marion	19.250	4	Completed	.....
Kansas Pipe Line & Gas Co.	Manhattan to Rocky Ford	3.31	8	Completed	.....
Kansas Pipe Line & Gas Co.	Lewis Field to main line	53.163	8	Completed	.....
Kansas Pipe Line & Gas Co.	Medicine Lodge to Kan.-Neb. state line	225.171	16	Completed	.....
Kansas Pipe Line & Gas Co.	Main line to Kingman, Kan.	4.991	4	Completed	.....
Kansas Pipe Line & Gas Co.	Main Line to Abilene	1.485 2.816 1.269	8 4 2	Completed	.....
Kansas Pipe Line & Gas Co.	Marion Junction to Davis well connection	6.688	4	Completed	.....
Kansas Pipe Line & Gas Co.	Main line to Concordia	17.829	8	Completed	.....
Kansas Pipe Line & Gas Co.	Main line to Belleville	7.253	6	Completed	.....
Kansas Pipe Line & Gas Co.	Rocky Ford 6 inch to Wamego	15.094	8	Completed	.....
Kansas Pipe Line & Gas Co.	Wamego 8 inch to St. Mary's and Wamego	12.811	4	Completed	.....
Kansas Pipe Line & Gas Co.	St. Mary's 8 inch to St. George	.884	2	Completed	.....
Kansas Pipe Line & Gas Co.	Lindsborg 4 inch to Marquette	6.586 3.570	4 2	Completed	.....
Kansas Pipe Line & Gas Co.	Main line 16 inch to Fort Riley	22.444	10	Completed	.....
Kansas Pipe Line & Gas Co.	Mullinsville to Calista	64.787	18	Completed	.....
Kansas Pipe Line & Gas Co.	Hanover to Seneca	19.777 30.367	6 4	Completed	.....
Kansas Pipe Line & Gas Co.	Seneca 4 inch line to Frankfort	8.870	3	Completed	.....
Kansas Pipe Line & Gas Co.	Missouri Valley 24 inch line to Washington	1.126	3	Completed	.....
Kansas Pipe Line & Gas Co.	Seneca 4 inch line to Blue Rapids	10.009	4	Completed	.....
Kansas Pipe Line & Gas Co.	Blue Rapids 4 inch line to Waterville	.369 4.108	4 2	Completed	.....
Kansas Pipe Line & Gas Co.	Manhattan 8 inch line to Junction City	.233	4	Completed	.....
Kansas Pipe Line & Gas Co.	Lewis Field to Larned	24.915	8	Completed	.....
Kansas Pipe Line & Gas Co.	Larned to Bison Field	28.000	6	Completed	.....
Kansas Pipe Line & Gas Co.	Bison Field to Great Bend	32.838	6	Completed	.....
Kansas Pipe Line & Gas Co.	Bison Field to Russell	38.743	6	Completed	.....
Kansas Pipe Line & Gas Co.	Great Bend to Ellinwood	10.538	5	Completed	.....
Kansas Pipe Line & Gas Co.	Bison Field to La Crosse	6.936	4	Completed	.....
Kansas Pipe Line & Gas Co.	Lewis-Larned 8 inch line to Kinsley	8.993	4	Completed	.....
Kansas Pipe Line & Gas Co.	La Crosse 4 inch line to Bison	.942	3	Completed	.....
Kansas Pipe Line & Gas Co.	Great Bend 6 inch line to Olmitz	1.312	3	Completed	.....
Kansas Pipe Line & Gas Co.	Misc. 2 inch transmission line construction	44.691	..	Completed	.....
Kansas Gas & Gasoline Co.	Hutchinson to Halstead field Barber Co. gas field to Medicine Lodge gasoline plant Field lines	22.376 6.465 25.475 5.000 25.697	8 16 8 10 4	Completed, 1930 and 1931	.....

(Continued on Page 86)

HYDRO-ELECTRIC DEVELOPMENT

FIG. 1. Two of the 25 hydro-electric plants of the Southern California Edison Co., Ltd. Big Creek No. 2 (in immediate foreground), 66,000 kw., and No. 2A, 93,000 kw., are located in the High Sierras about 50 miles east of Fresno, Calif. No. 2 plant operates on a water pressure of 1860 feet; No. 2A on 2400 feet.

Total generating capacity of all five power plants at Big Creek is 515,085 horsepower.

The World's Largest

A Description of Southern California

By R. M. BAUER

A DISTINCT trend away from hydro-electric power and toward steam plant generating facilities, in which natural gas provides most satisfactory fuel service, has been noted for several years. Mr. Bauer here contributes an interesting description of an outstanding steam plant, which burns natural gas in huge quantities to supply light and power needs of Southern California. The article is non-technical in treatment, laying particular stress upon burner design and gas usage.

R. M. Bauer

The author wishes to acknowledge with special appreciation the cooperation of J. W. Andree, production engineer of the Southern California Edison Co., who made available some of the basic data included in the discussion.—*Editor.*

THE Southern California Edison Co., Ltd., is probably the world's largest consumer of natural gas as power plant fuel. This company has pioneered in the utilization of natural gas for this use, and has done much development work in the design of burners and furnaces for the burning of natural gas under steam boilers.

The Pacific Light and Power Co., a predecessor of this company, owned a tract of land in the old Salt Lake oil field near Los Angeles on which were located some oil wells. These wells produced a considerable quantity of natural gas for which at times it was difficult to find a market. The company's engineers conceived the idea of transmitting this surplus gas to its Redondo steam plant for fuel. An agreement was entered into with the Southern California Gas Co. to transmit the gas to the Redondo plant. During the year 1913 two boilers were equipped for burning gas, and 42,000,000 cubic feet of gas were transmitted to this plant.

The Big Creek No. 1 and No. 2 hydro-electric plants (See Fig. 1) of this company were put into operation at about this time, which took practically all of the load from the Redondo plant, and no further use of gas fuel was made there until 1917, 1918 and 1919, when 26,349,000—753,907,000 and 201,842,000 cubic feet, respectively, were burned at Redondo. During 1920 and 1921, no surplus gas was available for plant fuel. The Redondo plant is now obsolete and is held as cold standby reserve, and active steam operation is now confined to the more modern Long Beach steam plant. (See Fig. 2).

The Long Beach No. 1 plant went into operation in August, 1911, with one 12,000 kw. vertical turbine. A second similar unit of 15,000 kw. capacity was added in February, 1913, a third of 20,000 kw. capacity was added March, 1914, and provisions were made for a fourth unit. The installation of additional units was delayed, however, on account of consolidation with the Pacific Light and Power Co., which had acquired extensive power rights on the Big Creek-San Joaquin River hydro-electric project and had started active development of it. From that time until 1924, the Edison company developed hydro-electric plant capacity exclusively.

During 1924 two 6,000 kw. and one 11,000 kw. horizontal turbo generators were installed in the Long Beach No. 1 plant in the space provided for the fourth unit. These smaller units were installed as an emergency measure and

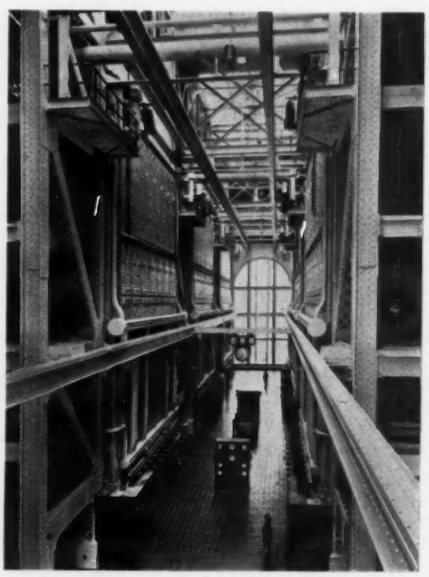
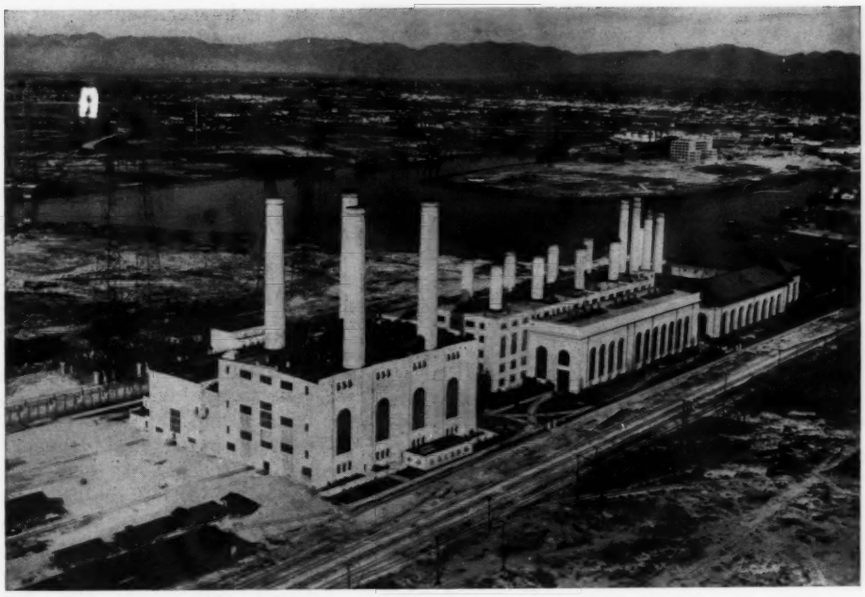


FIG. 3. Firing aisle of boiler room in Plant No. 3. The 20-inch gas headers are beneath the floor. There are 20 combination burners to each boiler.



STEAM PLANTS (GAS-FIRED)

FIG. 2. Airplane view of Long Beach steam plants Nos. 1, 2, and 3 (from right to left). Long Beach Harbor and Long Beach (Signal Hill) gas and oil field are seen in the background.

Southern California Edison Co.'s future program calls for added steam plant capacity rather than further hydro-electric development. At the Long Beach No. 3 plant 100,000 kw. units are being added at two-year intervals.

Industrial Consumer

Edison Co.'s Long Beach Steam Plant

Gas Supervisor and Office Engineer, Southern California Gas Company.

on account of quick delivery and urgent need for additional steam generating capacity. This installation completed the No. 1 plant with a total capacity of 70,000 kw. This plant has sixteen 777 h.p. boilers and sixteen 850 h.p. boilers. The steam pressure is 225 pounds and it has 125 degrees of superheat.

FIG. 4. Turbine hall in Plant No. 3. Units No.'s 10 and 11 are rated at 100,000 kw. each. The 21-inch shaft is 104 ft. long, one of largest ever built.

The Long Beach No. 2 steam plant has 145,000 kw. capacity and consists of three horizontal Curtis turbines, two of which are 42,500 kw. capacity each and one of 60,000 kw. capacity. No. 7 unit was put in operation December, 1924; No. 8 in January, 1925, and No. 9 in July, 1926. This plant has fifteen 1500 h.p. boilers with 400 pounds steam pressure and 250 degrees of superheat.

The Long Beach No. 3 plant (See Fig. 2) is laid out for installation of six 100,000 kw. units. At the present time two of these units are in operation. No. 10 was placed in service June, 1928, and No. 11 unit in March, 1930.

Description of Plant No. 3

This plant has six 3400 h.p. boilers, B. & W. sectional cross drum type, operating at 450 pound steam pressure and 300 degrees of superheat. It is a strictly modern and highly efficient plant. The boilers are mammoth structures (See Fig. 3) equal in height to that of a four-story building. The air for combustion is taken from the upper part of the boiler room, thus reclaiming a large portion of the best air which is radiated from the boiler setting. This warm air is then passed through an air preheater where it is heated to about 375 degrees, before entering the furnace, by the flue gas after leaving the boiler. In the furnace the air receives the heat of combustion and immediately imparts a portion of this heat to the water walls and the lower tubes of the boiler. The products of combustion then pass over the superheater, releasing heat to the steam, and then through the remainder of the boiler and through the air preheater, exhausting to the stack at a temperature of about 275°F.

The condensate from the turbine leaves the condenser at a temperature of about 80°F. This water is passed through a series of heaters in which it receives heat from steam, which is extracted from the turbine at various points in its path through the turbine. In each of these heaters the water receives an increment of heat and enters the boiler at a temperature of about 400°F. Upon entering the boiler the water first passes through the water-cooled walls of the furnace, then into the boiler proper, where it is converted into saturated steam. This saturated steam then passes from the steam drum of the boiler through the superheater, where it is heated to 750°F. and passes on to the turbine where its heat is converted into mechanical energy required by the electric generator. After leaving the turbine the steam is condensed and ready to start the loop again. In this cycle of operation about ½ of 1 per cent of the total amount of water evaporated is lost; hence this must be made up from an outside source. The boilers of this plant are normally operated at over 300 per cent of full load rating. This means that all boiler surfaces must be kept free from scale, and therefore only very pure boiler water may be used. The condensate from the condenser is naturally quite pure. The make-up water is first passed through a softener and is then double-distilled before it is used in the boilers.

The 21-stage turbines of this plant (See Fig. 4) require about 10½ pounds of steam per kilowatt hour; hence at full load they require approximately 1,000,000 pounds of steam per hour or 2,100 gallons per minute. To condense this steam requires 165,000 gallons per minute of condensing water or a stream of 367 second feet. The three plants combined operating at full load, require about 1500 second feet of circulating water—a good-sized river.

Natural Gas Requirements

The fuel requirements under these conditions are equal to 25,000 barrels of oil per day or 130,000,000 cubic feet of natural gas per day, which is equivalent to 5600 tons of coal, or about three train loads per day. Plant No. 3 normally requires 11½ cubic feet of natural gas for each kilowatt hour produced.

Natural gas is delivered to the Southern California Edison Co. by the Ventura Fuel Co. through Southern California Gas Co. and Southern Counties Gas Co. systems, and the Gas Department, City of Long Beach. Maximum delivery, over a period of 12 hours, in the past has been 3,125,000 cubic feet an hour. With the completion of a new 26-inch pipeline now being constructed from Kettleman Hills to Long Beach, about 6,000,000 cubic feet an hour will be available.

Burner Design

Long Beach No. 1 plant was originally designed as an oil burning plant, but with the development of the Long Beach gas and oil field in 1922, large quantities of natural gas became available as power plant fuel, and the company converted a number of the furnaces in this plant for burning either oil or gas. The first furnaces used consisted of a large number of Bunsen type burners distributed over the floor of the furnace, the gas burning up through a 3¼-inch iron tube. These iron tubes burned out frequently; hence fire clay tile tubes were used, which also caused trouble through breakage. In these first furnaces, front shot steam atomizing oil burners were used. The distribution of air for combustion was poor when using the oil burners, resulting in inefficient combustion. This design was modified by placing the burners closer together in the front part of the furnace floor and casting the burner openings out of fireclay or other refractory material, and then using rear shot oil burners located near the rear wall of the furnace. A system of dampers was designed which would admit air at will to either gas or oil burners. This type of furnace was cheap, efficient, and with the type of boiler and conditions existing at that time, met all requirements very satisfactorily.

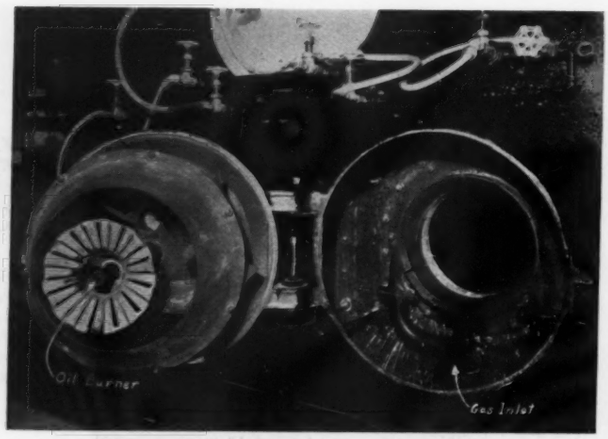


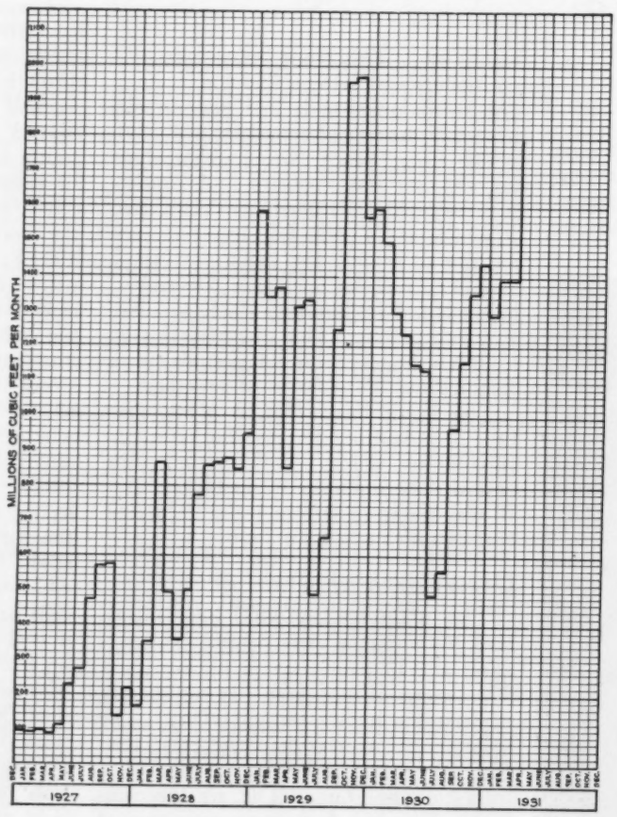
FIG. 5. Combination gas and oil burner used in Plants No.'s 2 and 3. Gas burner is stationary while oil burner is on hinged door (center). Air for combustion enters through space between gas burner and door and is given a circular motion by the vanes mounted on the door.

When the No. 2 plant was constructed with its larger boilers and higher rate of loading, mechanical atomization of fuel oil had been successfully developed. A combination oil and gas burner, to be mounted in the front wall of the boiler, was tried out, found satisfactory and has been used in both the No. 2 and No. 3 plants. These burners consist essentially of an annular ring opening, through which gas is admitted, and the air for combustion enters through the central circular area. The mechanical atomizing oil burner is in the center of the circle. (See Fig. 5.) The oil burner element is designed for quick insertion or removal, and is usually not in position when gas fuel is being used exclusively. This is for the purpose of avoiding burning or carbonization of the burner heads. At Plant No. 3 twenty burners fire each boiler.

Recording flue gas analysis apparatus on each boiler assists in maintaining proper air-gas mixtures to the burners.

Many other types of burners and furnaces have been tried out and tested in the No. 1 plant. The proper type of burner to be used depends largely upon the construction of the boiler and furnace, the operating conditions and the size of the installation.

Great advancement in design of steam power plants has been achieved during the past 20 years. This is evidenced by the fact that at the time of construction each of the Long Beach plants was strictly modern and the last word in design; yet the efficiency of the Long Beach No. 1 plant was only 220 kwh. per barrel of oil, and now at the No. 3 plant 487 kwh. are obtained with a barrel of oil fuel.



GRAPH NO. 1. Natural gas consumption, Southern California Edison Co. steam plant, Long Beach, Calif. Steam plant requirements are dependent on load requirements, weather conditions and rainfall conditions in the High Sierras.

(Continued on Page 100)

Second Annual Merchandising Review

Appliance Sales Hold Firm *in* 1930

By GEORGE H. FINLEY
Managing Editor, Western Gas

BEGINNING on the page immediately following, *Western Gas* offers its Second Annual Gas Appliance Merchandising Review — a detailed statistical analysis of the sales year for some 120 gas utilities in Western America.

As the work of compiling the review got under way one question was uppermost in the minds of the editors. Would the volume of 1930 gas appliance sales show the same shrinkage that other domestic commodities have experienced during the past year?

In an editorial feature of the February issue, giving preliminary information on sales of a few larger companies, *Western Gas* hazarded the general opinion that 1930 sales totals would compare favorably with those of the banner year 1929—despite curtailed purchasing in other lines, and despite the abnormally large gain which 1929 registered over 1928. Now that definite figures are available, there is no reason to revise this optimistic forecast.

Companies operating in every state west of the Mississippi, as well as in western Canada and in the Territory of Hawaii, have entered their sales figures in this year's review. A summary for all companies reporting gives the figure of $15,619,733 for 1930 merchandise sales, representing the bulk of gas appliance retailing by practically all major gas utilities of the western area.

Using only the totals from companies reporting sales for both 1930 and 1929, in order to keep the returns on a strictly comparable basis, it develops from the survey that the rapid sales pace set in 1929 was held practically constant through 1930. Here is the way the record runs:

1930 dollar sales for companies reporting for both years	$14,941,290
1929 dollar sales for the same group of companies	$15,255,086

These totals represent a decrease of $313,796, or 2.05 per cent, under 1929 —a remarkable showing, in the light of the fact that 1929 was the industry's outstanding sales year to that time, increasing over 1928 by at least 50 per cent! This fact is well substantiated in last year's gas appliance sales review.

SUMMARY: SECOND ANNUAL MERCHANDISING REVIEW*

Sold	1930	1929
Gas ranges	*51,182*	*47,261*
Hot Plates and laundry stoves	*8,874*	*6,031*
Water heaters	*34,209*	*31,318*
Space heaters	*50,582*	*48,291*
Furnaces	*5,457*	*5,984*
Furnace conversions	*22,742*	*15,477*
Total appliance sales	*$15,619,733*	*$15,273,108*

*Totals for all companies reporting (approximately 120 individual distributing companies). Since some returns omit 1929 totals, the above figures should not be used for exact percentage comparisons of 1930 and 1929.

Reading through the individual company records in the tables which follow, it will be apparent that the record of gain or loss is extremely difficult to gauge for its general trend. While 23 of the 64 companies submitting 1929-1930 figures show increases over 1929, and 41 show decreases, many of the latter are borderline, the totals being practically the same for the two years.

In an effort to check the general trend, the 10 highest company totals were selected for comparison. The result actually shows a slight increase over 1929—and these 10 companies accounted for $10,815,812 of the $14,571,749 total sales of all companies compared. This would seem to indicate that smaller companies suffered disproportionate losses in volume, these being offset by important gains of a few larger companies.

It is very apparent that last year's sales ran extremely close to those of the record year preceding—but this says nothing of the effort which was required to maintain the pace. There is no doubt but what the selling was harder, and results were achieved by greater effort. It is evident, for example, that more manpower was put on the sales line in 1930, to hold the level of load building.

It is illuminating in this connection to check the increase in meters against the number of salesmen added by companies submitting comparable returns. Thirty-two companies which have provided information on number of meters and number of salesmen for both 1930 and 1929 were checked. Additional salesmen to the number of 162 were noted for this group, against a meter gain of only 90,830. The greater part of the increase was accounted for by additions to sales personnel of larger utilities.

Obvious from the above, is the conclusion that sales results can be had in an indifferent sales year, providing the proper effort is expended—and that the gas industry is prepared to maintain its load-building promotion in the face of any unfavorable conditions.

An attempt has been made in this year's survey to make the returns more comparable than they would otherwise be, by indicating whether or not installation charges are included in each company's totals. In many cases it is impossible to segregate merchandise and installation totals, and where it is definitely known that these are lumped together, an asterisk is placed before the company name in the tables.

No appliance totals are given in the tabulation for refrigerators, portable incinerators, clothes dryers, or washers and ironers. Many companies have considerable entries under these heads, and this information will be reported in detail in *Western Gas* for June.

Totals for ranges, hot plates and laundry stoves, water heaters, space heaters, furnaces and furnace conversions are summarized elsewhere on this page.

To the many executives who have assisted in this merchandising review by making available the sales records of their companies, *Western Gas* extends appreciation. The results of the survey are particularly gratifying this year, indicating as they do that the industry has thrown added effort behind its merchandising departments and has kept the front of its sales advance unbroken.

Pages 46-49, inclusive, present the detailed company returns.

Second Annual "Western Gas"

GAS APPLIANCE MERCHANDISING REVIEW

Covering Sales and Quotas of Western Utilities

1930 Sales | 1929 Sales | 1931 Quotas

COMPANY	RANGES			HOT PLATES AND LAUNDRY STOVES			WATER HEATERS			SPACE HEATERS			FURNACES			FURNACE CONVERSIONS			NUMBER METERS 1-1-31	NUMBER SALES-MEN 1-1-31	TOTAL APPLIANCE SALES (In Dollars)		
	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931			1930	1929	Quota 1931
ARIZONA																							
The Arizona Power Co., Prescott	9	8	15	24	16	25	9	9	15	12	10	15							1,101	1			
The Tucson Gas, Electric Light & Power Co.	217	290		52	82		51	108		7	17		7	17					5,200	4	28,489	32,290	
ARKANSAS																							
Little Rock Gas & Fuel Co.†	1,535		1,005	14			879		700	2,724		2,236	32			150		8	29,665	30	378,205		249,193
Mansfield Gas Co.																					625	715	
CALIFORNIA																							
Coast Counties Gas & Electric Co., Santa Cruz	732	702	825	84	83	100	547	574	700	719	630	850	135	131	200	117	90	150	16,400	14	220,333	129,562	296,975
Natural Gas Corp. of California, San Francisco	684		500	465		600	240		200	518		800	6		12			10	2,936	10	96,359		101,000
Pacific Gas and Electric Co., San Francisco								2,669			4,354			968		12,331		8,000	474,751	128	2,127,737	1,013,971	
San Joaquin Light & Power Co., Fresno‡	1,183	72		††	††		1,109	72		1,914	200		104	38		‡‡669			18,584	5	39,927	38,443	
Santa Maria Gas Company	163			114			131			328			5						8,215	2	53,085	58,760	
Southern California Gas Co., Los Angeles		**2,339			**111			1,387			1,480			526								524,797	
Southern Counties Gas Co., Los Angeles	2,461	2,919	3,000	50	49	55	1,761	1,867	2,500	3,073	3,328	3,475	277	363	400				140,000	40	731,334	817,391	851,805
West Side Natural Gas Co., Taft	18						5			21									3,700	1	3,369		
CANADA																							
B. C. Electric Power & Gas Company, Ltd., Vancouver, B. C.	1,236	1,283		688	682		641	528		1,027	1,166		32	75					43,000	14	18,809	218,112	
Victoria Gas Co., Victoria, B. C.	129	140	142	107	126	118	40	70	60	74	98	88	1	11	5				4,442	3	16,082	17,667	17,750
Winnipeg Electric Co., Manitoba	237	107		21	41		62	60		5	8		2	5			1		17,977				

†Arkansas division, Arkansas Natural Gas Corporation.

‡Dealers sales for Sept., Oct., Nov. and Dec., 1930 are included under 1930 totals for several classifications.

††Included in "ranges" total.

‡‡Includes boilers.

**Excluding hotel and restaurant sales.

COMPANY	RANGES			HOT PLATES AND LAUNDRY STOVES			WATER HEATERS			SPACE HEATERS			FURNACES			FURNACE CONVERSIONS			NUMBER METERS 1-1-31	NUMBER SALESMEN 1-1-31	TOTAL APPLIANCE SALES (In Dollars)		
	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931			1930	1929	Quota 1931
COLORADO																							
Canon City Gas Co.	14		25	6			10		25	2		50							700		2,183		4,365
*Public Service Company of Colorado, Denver	1,259	1,404	1,584	176		176	2,414	2,815	2,521	1,820	1,665	1,543	920	1,126	1,162	1,120	2,996	363	75,529	64	902,976	1,249,619	857,000
Pueblo Gas & Fuel Co.	275	685	400	36	43		198	614	300	246	844	150	74	159	100	42	364	50	4,772	5	100,750	267,605	139,000
The Trinidad Elec. Trans. Ry. & Gas Co.	24	15		5	7		14	12		2	1			1					650	1	1,945	1,527	
HAWAII																							
Honolulu Gas Co., Ltd.	713	600		178	200		184	200		2									14,144	5	88,545	97,645	
IOWA																							
*Council Bluffs Gas Co.	181	385	850	50	66	300	60	147	350	25	30	400	1		75	5		500	8,500	7	23,415	43,777	300,000
Des Moines Gas Co.	1,102	1,221		176	191		1,122	611		173	205		132	37		49			33,788	12	258,341	176,273	250,000
*Ft. Dodge Gas & Electric Co.	123	117	115	41	37	75	134	96	150	2	4	22	2	2	12	1		30	3,987	3	16,943	13,806	18,500
*Iowa City Light & Power Co.	162	159	190	38	39	40	88	85	110	5	9	20					1	2	3,833	2	19,790	18,707	21,144
Iowa Public Service Co., Sioux City	362		440	152			176		230	9			3						22,213	15			
Le Mars Gas Co.	14	7	25	6	11	20	4	20	25										814		921	1,107	2,100
*Ottuma Gas Co.	132	155	200	42	58	75	74	70	105	8	16	15	2	1	6				4,610	2	33,211	32,207	36,000
*Sioux City Gas & Electric Co.	341	539	495	133	155	134	310	366	360	19	30	134							19,650	12	†216,251	†317,344	†72,677
KANSAS																							
*Central Kansas Gas Co., Hays	53	10	75	71	15	100	85	20	150	121	28	185	7		25	102	73	100	429	1	40,438	20,000	45,000
*Clayton Gas Co., Independence	50	68		13	22		41	65		100	184					16	15		480		14,572	24,285	
*Dalhart Gas Co., Independence	27	70		8	15		18	55		47	110					15	26		1,350		5,669	14,948	
Ellis County Gas Co., Ellis	16		65	10		75	5		50	20		125	1		10	23		75	123	1	9,372		25,000
Union Gas Corp., Independence	28	68		2	5		6	7		102	189		6	1		168	194		14,397		12,634	20,693	
The Western Utilities Stores Co.‡	78	243		33	78		70	209		90	52			2		6	3		3,800		15,131	††62,576	100,250
LOUISIANA																							
Baton Rouge Electric Co.	433	277	405	23	21		223	213	235	1,282	1,379	1,294	29	45	46	10	9	35	5,291	3	80,847	67,336	87,837
*Louisiana Power & Light Company, New Orleans	443	158	660	43		50	98	9	264	710		1,000	10						5,728	4	65,677	24,148	81,000
*Louisiana Public Utilities, Lafayette	73	93	90	5	4	6	66	20	67	142	130	222							1,850	2	‡‡9,595	11,614	17,555
New Orleans Public Service Inc.	2,217	2,486	2,600	398	440	350	585	463	720	3,244	3,041	3,500							75,518	30	239,803	255,733	304,000
Southern Cities Distributing Co., Shreveport	**189		425	**6		25	**140		250	**616		1,025	**2		5			5	20,000	6	34,000		68,000
Southwestern Gas & Electric Co., Shreveport	11	242	300	46	56	50	21	106	220	309	612	600	11			5	5	50	3,130	2	21,033		60,000

*Includes installation charges.

†1930 and 1929 totals include gas and electric sales; 1931 quota includes gas only.

‡Includes Western Natural Gas Co., Western Gas Co. of Washington, and Western Gas and Utilities Co.

††Properties affecting 1929 totals were disposed of during latter part of that year. Total 1929 sales for properties retained covered in 1930 totals were $8,809.23

‡‡1930 total does not include installation charges.

**Six months sales only.

COMPANY	RANGES			HOT PLATES AND LAUNDRY STOVES			WATER HEATERS			SPACE HEATERS			FURNACES			FURNACE CONVERSIONS			NUMBER METERS 1-1-31	NUMBER SALES-MEN 1-1-31	TOTAL APPLIANCE SALES (In Dollars)		
	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931			1930	1929	Quota 1931
MINNESOTA																							
City of Duluth Water & Light Dept.	99	199	250	28	59	75	35	54	150	28	54	70			25	30	15	100	21,500	2	10,918	20,663	70,000
*Minnesota Northern Power Co., Minneapolis	2,242	1,365		829	500		1,899	1,354		3,257	2,462		435	291		825	316		13,000	46	1,154,911	915,286	1,110,000
*Minneapolis Gas Light Co.	2,500	2,000	2,500	100	75	200	2,000	2,300	2,000	147	240	525	100	75	200	5	3	250	123,000	35	700,000	800,000	850,000
Northern States Power Co., Minneapolis	1,407	1,620	1,661	410	452		1,099	1,055	1,552	72	67	133							63,889	17	195,233	214,723	
MISSOURI																							
*Gas Service Co., Kansas City†	9,879	11,649		493	367		6,301	5,002		11,490	12,072		1,810	1,439		5,483	10,173		235,830	228	3,521,181	4,236,081	
*The General Utilities Company, Kansas City	800	350	1,200	150	65	100	237	105	350	569	220	1,050	38	14	75	164	43	300		20			
*The Laclede Gas Light Co., St. Louis	1,190	1,934		293	436		1,157	1,478		800	683		13	18		140	73		219,823	90	385,564	522,045	
National Utilities Co. of Mo., Kirksville	118	90	125	64	30	50	17		25	6									1,488	1			
St. Louis County Gas Co. Webster Groves	324	459	500	136	185	200	500	515	1,200	50	51	100	118	169	165	35	6	35	38,510	11	‡74,931	‡89,650	‡168,000
MONTANA																							
Cut Bank Gas Utilities	18			5			36			65			1			31			129	1	6,100		
*Great Falls Gas Co.	286	483	500	52	82	40	237	334	415	315	465	500	43	101	200	58	188	175	4,925	6	112,433	169,767	194,450
The Montana Power Co., Butte	13	18		10	4		16	26		4									3,548		2,022	3,046	
NEBRASKA																							
*Central West Public Service Co., Omaha	294		333	155		134	126		233										3,340	5	27,500		
*Metropolitan Utilities District, Omaha	774	796		180	226		479	456		136	129		107	93		††30	††24		50,892	7	189,051	178,104	
NEVADA																							
Sierra Pacific Power Co., Reno	66	102	100	55	69	65	56	106	85	1	5	10							2,837	4	8,036	15,093	15,000
NEW MEXICO																							
*Albuquerque Gas & Electric Co.	254	285	300	41	91		222	224	190	60	8	222	13		90			95	3,619	3	32,923	27,415	157,960
OKLAHOMA																							
*Cimarron Utilities Co., Guymon	65	17	60	22	16		12	13	24	316	96	360	12	7	12	4	2		1,862	1	17,260	9,179	
MacThwaite Oil & Gas Co., Ada	8	21	17				1	3		9	23	13							2,984				
*Oklahoma Natural Gas Corp., Tulsa	1,839	2,735		12			776	720		2,490	3,469								98,419	37	420,388	540,837	
Oklahoma Power & Water Co., Sand Springs	33	41	85				4	2	60	71	62	80							4,381	3	6,182	5,047	15,075
*Oklahoma Utilities Co., Bristow	49						15			86									3,600	7	55,910	53,089	
Public Service Co. of Oklahoma, Tulsa	14	21					1	3		22	21								2,910	2	1,540	2,165	
Southwestern Light & Power Co., Oklahoma City	184	143					32	25		287	369								11,702	6	26,996		

*Includes installation charges.

†Gas Service Co. totals cover sales of the following subsidiary companies: Carthage Gas Co., Jackson County Light, Heat & Power Co., Joplin Gas Co., Kansas City Gas Co., Ozark Distributing Co., St. Joseph Gas Co., Webb City & Carterville Gas Co., The Arkansas Valley Gas Co., Capital Gas & Electric Co., Girard Gas Co., The Hutchinson Gas Co., The Newton Gas Co., The Pittsburg Gas Co., Union Service Co., The Western Distributing Co., The Wichita Gas Co., The Wyandotte County Gas Co., Nebraska Distributing Co., Bartlesville Gas & Electric Co., Consumers Gas Co., Union Public Service Co.

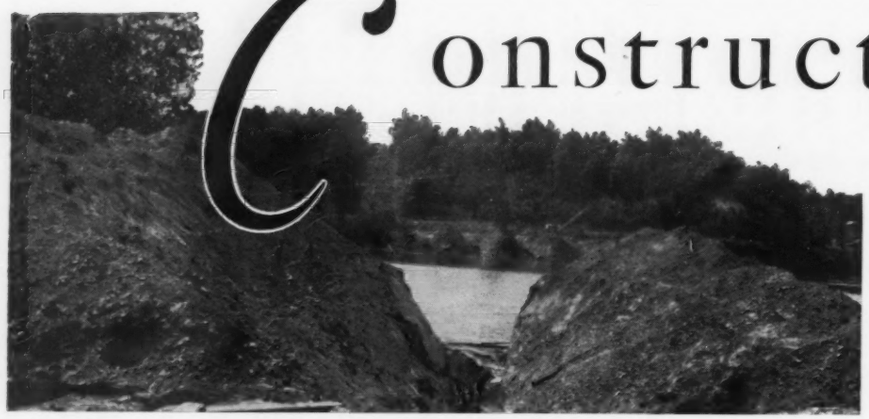
‡Not including furnaces and conversions.

††Includes boilers.

COMPANY	RANGES			HOT PLATES AND LAUNDRY STOVES			WATER HEATERS			SPACE HEATERS			FURNACES			FURNACE CONVERSIONS			NUMBER METERS 1-1-31	NUMBER SALES-MEN 1-1-31	TOTAL APPLIANCE SALES (In Dollars)		
	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931	Sold 1930	Sold 1929	Quota 1931			1930	1929	Quota 1931
OREGON																							
Natural Gas Corp. of Oregon	52		500	106		550	79		300	124		1,250	2		24			20		14	14,354		104,000
*Portland Gas & Coke Co.	2,606	1,613	2,150	420	207	350	1,561	1,438	1,440	515	653	550	†136	†157	†150				111,171	38	446,721	414,381	453,000
Southern Oregon Gas Corp., Medford	109			168			169			93									2,011	1	5,866	7,122	
SOUTH DAKOTA																							
Northwestern Public Service Co., Huron	382	467	414				229	226	242	17	22	40	6	5	10	31	18	34	9,075	7	41,222	45,210	50,000
Yankton Gas Co.	55			20			5			2						1			900		5,134		7,200
TEXAS																							
*Community Natural Gas Co., Dallas	1,547						1,130			4,223									65,859	40	369,541	‡‡‡300,000	
*Empire Southern Gas Co., Denton.‡	67						33			75									5,205		2,999		
Rio Grande Valley Gas Co., McAllen	539	653		212	475		247	318		761	1,412								8,831		70,521	90,040	
Sabine Utilities Corp., Port Arthur	1,019	1,159	569							425	889	265							10,198	4	147,827	192,137	109,013
*San Antonio Public Service Co.	418	450	500	28	21	35	249	259	350	956	864	1,250	6	4	20	34	34	50	41,799	8	90,489	85,589	110,000
Texas Border Gas Co., Laredo	219			26			9			227									5,500	4	27,621		
Texas Cities Gas Co., Dallas	878	1,895	751				534	704	721	1,800	4,207	2,135	38			283	293	222	36,085	24	290,799	462,312	315,000
Texas Public Service Co., Austin	441	490	450				212	214	300	483	755	576	27	29	22	†39	73	†94	9,356	5	95,000	111,500	114,000
*United Gas Public Service Co., Houston			8,455			828			3,824			3,562							87,732	60			1,381,382
*West Texas Gas Co., Lubbock	566	652		58	159		328	411		982	1,219					54	90		16,379	2	††14,118	††22,582	
*West Texas Utilities, Abilene	68	49	60							141	254	306							49,164		2,826	3,050	3,500
UTAH																							
*Ogden Gas Company	288	209		41	27		302	201		456	326		99	47		98	186		3,928	3	119,671	94,270	
Uintah Gas Company, Vernal	25	51	20	‡‡29	‡‡52	‡‡20	30	48	25	43	99	27	2	3	2	1	39	2	162	2	9,018	20,100	6,700
Utah Gas & Coke Company, Salt Lake City	497			132			1,055			1,306			480			504			15,000	14			
WASHINGTON																							
Natural Gas Corp. of Washington			450			500			150			705			10			10		5			95,000
Northwest Cities Gas Company, Walla Walla	379	231	500	94	127	150	222	197	300	102	140	200		1			1		10,016	3	50,400	50,912	75,000
Puget Sound Power & Light Co., Seattle	96	159	116	33	32	37	48	41	69	22	13	37	2	15	6	1		6	3,404	2	13,063	14,611	
*Seattle Gas Co.	2,400		2,900	**1,000		**1,300	1,375		1,800	550		865								30	425,000	259,776	600,000
*Spokane Gas & Fuel Co.	221	298	350	33	37	100	242	199	350	35	27	165	9						9,000	7	65,005	76,884	89,400
*Washington Gas & Electric Co., Tacoma	900			506			675			475			143			†††			17,160	11	157,076	139,085	
WYOMING																							
*The Cheyenne Light, Fuel & Power Co.	217	181		13	24		154	173		108	136		7	8		†39	†115		2,693	2	54,766	68,474	77,000
*New York Oil Company, Casper	44			2			25			106			9			62			6,400	2	23,218		

*Includes installation charges.
†Includes boilers.
‡Includes Empire Southern Service Company.
††Less cost of merchandise.
‡‡Includes range burner conversions.
**Includes miscellaneous appliances,
†††Included in "furnace" total.
‡‡‡Approximate.

Constructing the



Where the Panhandle Eastern Pipe Line Enters the Wabash River

By A. FAISON DIXON

Brokaw, Dixon, Garner & McKee Geologists and Petroleum Engineers New York.

IN this description of the Panhandle Eastern Pipe Line Company enterprise, Mr. Dixon and his organization have prepared for the Natural Gas Edition of *Western Gas* what is perhaps the most comprehensive review yet published on a major gas transmission project. The contents deal with engineering features of the undertaking, which were in charge of the firm of Brokaw, Dixon, Garner & McKee, of New York. Market analysis, line survey, together with inspection of all construction, were among the details handled for the Panhandle Eastern Pipe Line Company by this organization.

A. Faison Dixon

Assisting in the assembling of data for this valuable article were the following members of the Brokaw, Dixon, Garner & McKee staff: Construction, Inspection and Testing—S. J. Hickson and John R. Chamberlin; Material Handling—A. C. Sampson; Communication System—D. D. Pickrell.

This feature is commended to *Western Gas* readers as a practical contribution to the technique of developing and carrying through gas transmission line projects.—*Editor.*

DURING the first part of January, 1930, the Missouri-Kansas Pipe Line Co. acquired considerable acreage of gas lands in the Texas-Panhandle with the idea of bringing gas to an eastern market, Frank P. Parish being the head of the enterprise and B. R. Bay in charge of operations. An active campaign of lease purchasing was inaugurated and an intensive fuel survey started. About the same time the project was transferred to the Panhandle Eastern Pipe Line Co., which was formed for this purpose.

The work was planned and carried on by the Missouri-Kansas Pipe Line Co. up to about September 1st, 1930, when the Columbia Oil and Gasoline Corp. bought a one-half interest in the project. Since then it has been a joint operation of these two companies. Fred W. Crawford, now president of the company, and A. W. Leonard became the active representatives of the Columbia's interests and, with Mr. Bay, the active executive officers in charge.

The engineering features of the enterprise fall under several headings which were carried on in somewhat the following order, although the time covered in the various operations of course overlapped to some degree:

1. Study of gas reserves.
2. Fuel survey of markets.
3. Laying out project on paper.
4. Surveying of line on ground and aerial surveys.
5. Inspection of construction and material handling.

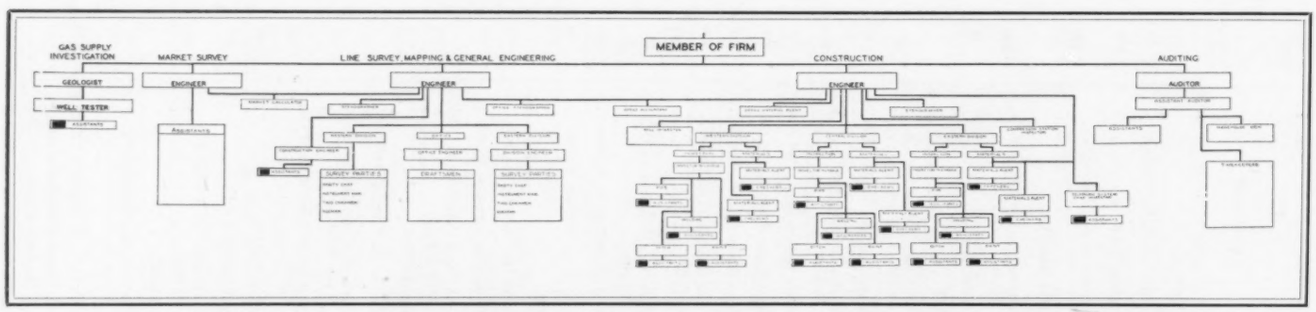
The Fuel Survey

All cities and towns were covered which seemed to be in possible economic distance of the projected route of the main pipe line, and the data collected were used in determining the route of the line and the size of the laterals.

The method of making the fuel survey was as follows:

Our representatives called on all fuel consumers who seemed likely to have an annual fuel consumption of over $200. The facts as gathered were jotted down in a loose leaf note book on the form shown in Fig. 1. All available statistics were gathered regarding amount and kind of oil and gas shipped into the city and the average consumption of private houses was estimated as closely as possible. As the pipe line traversed a territory of cheap coal, the market was necessarily highly selective and the object of the survey was not to determine the total fuel consumption but to tabulate the loads which could use gas advantageously.

Data from each town were tabulated and studied and an estimate made of what would be the probable market for gas at various prices. Probable load fac-



Organization chart, Kansas City office, Brokaw-Dixon-Garner & McKee, firm in charge of engineering features on Panhandle Eastern Pipe Line Co. project

Panhandle - Eastern Line

A Thorough-Going Engineering Review of This 1000-Mile Project

tor under varying conditions was also estimated in each case. The facts regarding each town, even including the smaller villages, were summarized and tabulated on the form shown in Fig. 2.

Surveying

The objects of the survey for the pipe line were to locate the line on the ground so that right of way could be purchased, so that contractors bidding on the construction might see the proposed location of the line, and so that data for details of design and location for actual construction would be available.

It was desired to transmit natural gas from the gas producing areas in the Panhandle of Texas and in southwestern Kansas, to certain markets in Missouri, Illinois, and Indiana. Due to its great cost per mile, the main line was located on the most direct line from the common gathering point of the gas near Liberal, Seward County, Kan., to the largest proposed market in the general region of Indianapolis, Ind., at the same time keeping it close enough to other large markets in Missouri and Illinois that they could be economically served by lateral lines.

The next consideration was the general type of country to be traversed, with a view to locating the line along divides where possible, in an effort to minimize the number and size of streams and flood valleys to be crossed.

The paper location was made upon the U.S.G.S. maps of the various states, scale 1:500,000. Topographic maps by

BROKAW, DIXON, GARNER & McKEE
120 Broadway, New York

FUEL SURVEY DATA

City ________ Date ________
Company ________
Location Plant ________
City Office ________
Manager or Supt. ________
Kind of Plant ________
Uses for Fuel ________

OPERATION

MONTH	FUEL AMOUNT	FUEL PRICE	MONTH	FUEL AMOUNT	FUEL PRICE
Jan.			July		
Feb.			Aug.		
Mar.			Sept.		
April			Oct.		
May			Nov.		
June			Dec.		

Total Consumption for Year ________
Total Annual Consumption for Period ________ Yrs. ________
Kind of Fuel ________
B. T. U. of Fuel ________
Cost of Fuel ________
Handling Cost to Plant ________
Firing Cost to Plant ________
Existing Fuel Contract ________
Remarks: ________

Data Supplied by ________

Fig. 1. Loose leaf note book form on which fuel survey facts were noted.

BROKAW, DIXON, GARNER & McKEE
GEOLOGISTS AND ENGINEERS
120 Broadway—New York, N. Y.
GENERAL FUEL SURVEY DATA

DATE ________ 1930.
TOWN ________ STATE ________
COUNTY ________ COUNTY SEAT ________
INCORPORATED ________ MAYOR ________
CITY SECY. or CLERK ________ SECY. CHAMBER COMMERCE ________
POPULATION ________ NO. OF HOMES ________ NO. OF BUS. HOUSES ________
CH. OF COM. EST. TOTAL COAL CONSUMPTION ________ TONS
IND. CONSUMPTION ________ DOM. CONSUMPTION ________
NAME OF GAS COMPANY ________ AFFIL'N ________
KIND OF PLANT ________ CAPACITY ________ TOTAL YRLY. OUTPUT ________
MAX. DAILY LOAD ________ MIN. DAILY LOAD ________ MAX. HOURLY LOAD ________
HOLDER CAP'Y. ________ % CAST & STEEL LINES ________ BUILT ________
ANNUAL FUEL CONS. ________ KIND FUEL ________ COST ________
TOTAL NO. METERS ________ DOMESTIC ________ COMMERCIAL ________ INDUSTRIAL ________
% LOSS & UNACCOUNTED FOR ________ B. T. U. CONTENT PER CU. FT. ________
TOTAL MILES MAIN ________ HIGH PRES. ________ INTERMED. ________ LOW ________
DEGREE DAYS ________ COST OF GAS IN HOLDERS ________
SCHEDULE OF RATES:
NAME OF ELEC. CO. ________ AFFIL'N. ________
TOTAL NO. METERS ________ DOMESTIC ________ COMMERCIAL ________ INDUST. ________
CAPACITY ________ K. W. TOTAL OUTPUT ________ K. W. H.
ANNUAL FUEL CONS. ________ KIND FUEL ________ COST ________
NAME OF WATER CO. ________ AFFIL'N. ________
ANNUAL FUEL CONS. ________ KIND FUEL ________ COST ________
TOTAL NO. METERS ________ FLAT RATE CONSUMERS ________
NUMBER OF TELEPHONES ________ R. R. ________

WORK SHEET NO.	PRINCIPAL INDUSTRIES	USES OF FUEL	UNITS OF FUEL	KIND OF FUEL	DEL. COST PRICE PER UNIT	EST. HDLG. AND FIR. PER UNIT

See Reverse Side for Additional Data.
*Estimated.

By ________

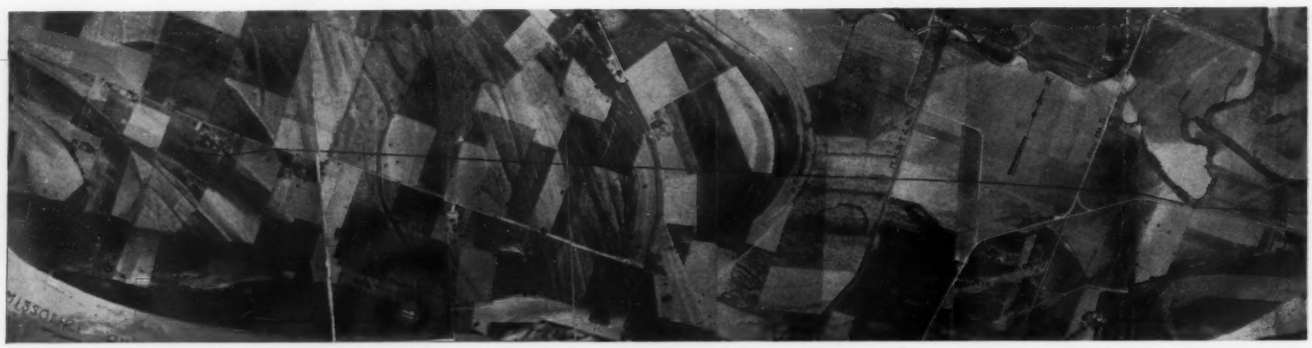
	Potential Gas Market Per Year M. C. F.	Potential Market Per Day M. C. F.	Potential Peak Per Day M. C. F.	Est. of Load End of 3 Years M. C. F.	Est. Annual Load End of Three Years M. C. F.	
Domestic Cooking						
Domestic Heating						
Commercial Non-Htg.						
Commercial Htg.						
Industrial						
Totals						

KEY TO FUEL USES
SH—Space Heating
SG—Steam Generation
PG—Power Generation
EG—Elec. Pow. Gen.
OV—Baking Ovens
EN—Enameling Ovens
AN—Annealing
CP—Cupola
CO—Cooking
HW—Hot Water
HT—Heat Treating
SZ—Sterilizing
DR—Drying
AC—Art. Gas Gen.
HH—House Heating
KL—Kiln Uses
FG—Forging
BS—Blacksmithing
PZ—Pasturizing
ML—Melting

WORK SHEET NO.	PRINCIPAL INDUSTRIES	USES OF FUEL	UNITS OF FUEL	KIND OF FUEL	DEL. COST PRICE PER UNIT	EST. HDLG. AND FIR. PER UNIT

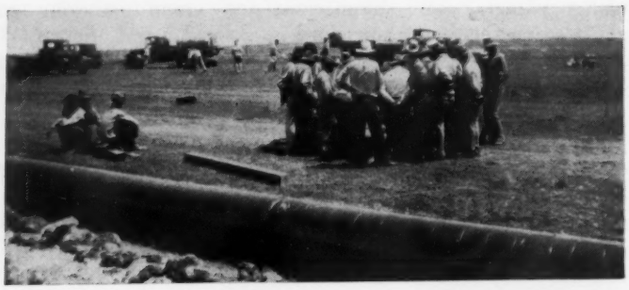
REMARKS:

Fig. 2. Form for tabulation of fuel survey data from individual towns. Both sides of form are shown.



Approximately 400 miles of the Panhandle Eastern line was mapped by aerial photography. It was estimated that a minimum saving of 4 feet of main pipe line per mile through use of aerial maps, would pay for their cost.

Taking profile of Mackinaw River crossing, on the Peoria lateral.



It's the old army game—at lunch time, on a 22-inch section.

the U.S.G.S., scale 1:125,000, were also used where they were available. Where it was necessary to cross streams of any consequence, especially those requiring a manifold type of crossing, the point of crossing was accurately located on the ground by a man experienced in this work; and these points were made objective points for the survey.

Other details determining the location, with their corresponding considerations, were as follows: Crossing of highways and railroads at fills, never at cuts; crossing minor streams at the most suitable location near the proposed route; oil fields, cities and towns—to keep a sufficient distance with the location to care for their future expansion; farm houses and buildings—to clear by a reasonable, safe distance; orchards and other types of high class cultivation—to avoid, if possible.

Survey parties were organized in the Kansas City office and placed in the field at various points along the line from Borger, Texas to Indianapolis, Ind. At one period there were 14 surveying parties in the field. The personnel of each surveying party consisted of the chief of party, instrumentman, two chainmen, and one stakeman. Parties working in parts of the country where brush, woods, and vegetation interfered with the progress, carried one or two axemen in addition.

Survey parties were equipped as follows:

Ford,2-door sedan, with stake board on left fender.	Keel
Transit	Water bag
Chicago steel tape, 100 ft.	Stakes
Pocket tape, 50 ft. metallic	Flag cloth
Chain menders	Detail paper
2 range poles, 8 ft.	Notebook
Level rod, 12 ft.	Book sack
Hand axe	1 plumb bob
Axe (single bit)	12 in. triangular scale
Brush knife (machete)	6 in. flat scale
Chaining pins	12 in. 45° triangle
	6 in. 30°-60° triangle
	6 in. protractor
	1 first-aid kit

Notes were recorded on loose-leaf Lefax notepaper, in duplicate. The original copy of notes was mailed to the Kansas City office each day, the carbon copy being retained by the party chief in case of loss in the mail of the original, and for his own future reference. By using the loose-leaf system of notes, it was not necessary to wait until a field book was filled before sending the notes to the office. Field notes were received in the office each day from each party, and the mapping was kept up to date.

The amount of line surveyed per day per party varied greatly, depending largely, however, on the type of country. The record was 11 miles in one day by a party working on the plains of western Kansas. Daily averages of a week's work were as follows:

Party No.	Location	Average Mi. per Day
1	Western Kansas (Open plains)	6.0
2	Western Missouri (Wooded, hilly)	1.9
3	Eastern Missouri (Wooded, rolling)	2.4
4	Western Kansas (Open plains)	7.3
5	Central Kansas (Rolling sand hills, open)	6.0
6	Western Indiana (Wooded, rolling)	3.5

Notes were recorded as for railroad location. The accuracy used in railroad location, however, was not required in this work. Chaining was accurate enough if it checked with that of the Government land surveys. Extreme accuracy of reading angles was unnecessary, since the office plotting was done with protractors, reading to 15 minutes.

Stakes 1-in. x 2-in. x 14-in. long were set every 200 feet. At points of intersection and in each side of highway and railroad crossings, hubs and guard stakes were set. Marker stakes 1-in. x 2-in. x 5-ft. long, with red flag 18-in. square securely tacked to the top part of the stake, were set on each side of road crossings, fences, tops of hills, and other conspicuous points.

The stationing of all property lines, fences, drainage, roads, railroads, power lines, telephone lines, and other major features, was recorded. When crossing section lines or quarter section lines, angles of intersection were noted, and the point of crossing tied to the nearest section or quarter section corner. All buildings and improvements within 300 feet of the line were located. Unusual soil condition, rock outcrops, state of cultivation, and crops were noted. Roads were classified as A, B, C, and D, denoting concrete or brick surfacing, gravel surfacing, improved earth, and trails, respectively. Many other details, too numerous to mention here, were recorded. At night, each party plotted

the notes taken during the day on detail paper. By having at hand the Government measurements on the sections traversed, errors in chaining, reading angles, or the failure to record notes correctly were found, and corrections made the following day.

The main work done by the field parties included locating the main pipe line, lateral distributing lines, and gathering lines in the gas fields; obtaining the names of the property owners through whose lands the lines were located; making detail topographic surveys, soundings, and profiles for manifold river crossings—and securing data for the same on navigable streams, required by the War Department; making boundary survey, topographic surveys, and soil tests for compressor stations; survey of main line measuring station sites, meter and regulator station sites for lateral lines; special surveys of tracts of land for condemnation proceedings; staking the telephone line; and final measurement of the pipe line and telephone line. As actual construction began, survey parties were assigned districts of approximately 150 miles each, to re-stake the line (as most of the stakes were destroyed during the harvesting and cultivation of crops), and to take care of other construction details as they presented themselves. For the final measurement of the completed pipe line, the chaining was done along the natural slope of the ground to obtain the actual footage of the pipe laid. In the final measurement, the detailed condition of the line and right of way was reported as to backfill, road crossings, fences, materials and debris left.

Mileage of Pipe Line Surveyed

Main line	929.2
Gathering lines	142.1
Lateral lines	340.3
Total miles surveyed	1,411.6

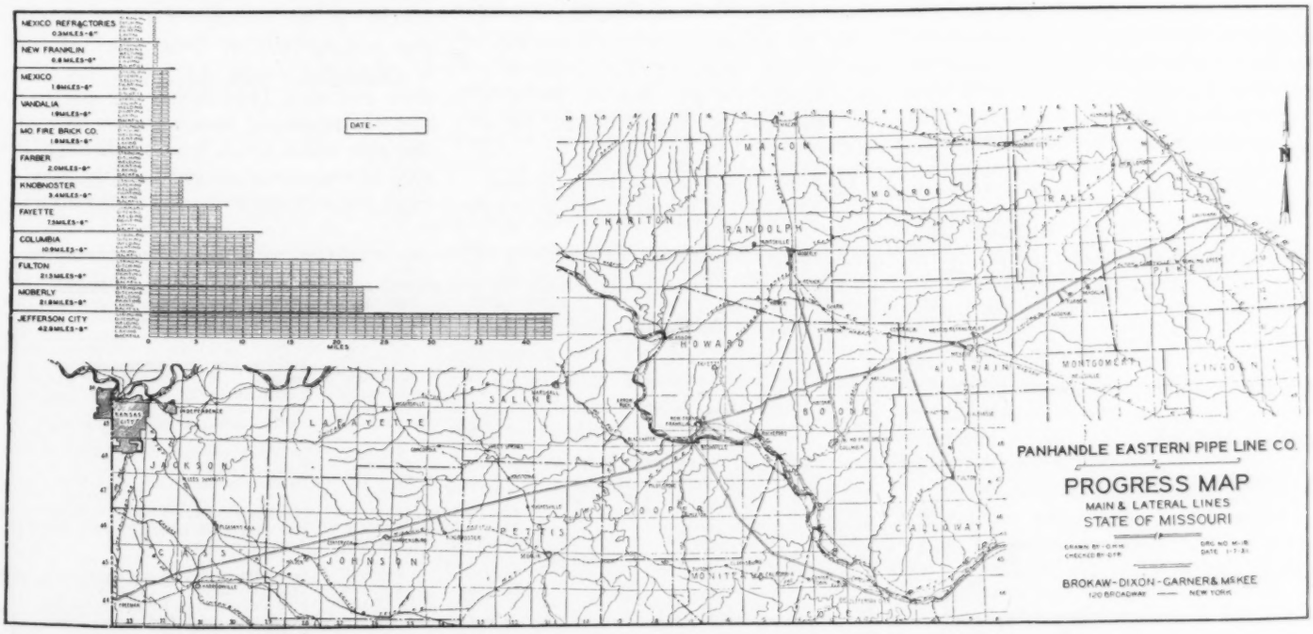
Aerial Mapping

Approximately 400 miles of the proposed location was mapped by aerial photography. One portion thus mapped extended from the Lamine River about 10 miles west of Boonville, Mo., on a line slightly north of east, to Casner, Ill., which is about 10 miles southeast of Decatur, Ill. The other part extended from Indianapolis, Ind., due west to the Illinois state line.

The work was done by the Curtiss-Wright Flying Service, the crew consisting of pilot and photographer. Location of the line to be mapped was marked on U. S. G. S. Topographic Maps, scale 1:125,000; and the territory actually mapped covered the line of these maps with surprising accuracy. A departure from the usual procedure in aerial mapping was incorporated in this work. The usual method is for the company doing the aerial mapping to turn out a completed mosaic map, while all asked in this case was a set of contact prints, scale 1 in.—1,000 ft., and two sets of enlargements, scale 1 in.—600 ft. Flying at an altitude of approximately 12,000 feet, each contact print covered an area approximately 8,600 feet wide by 7,000 feet in length along the line of flight. Approximately 60 per cent overlap, or 30 per cent on each side of the print in line of flight, occurs on each print.

One set of the enlargements was matched on the overlap, and the overlap on each end cut off on a cutting board. The middle portions of the prints were then mounted on cloth in convenient lengths. After drying, a fine thread was stretched between pins at the ends of the strip this formed, which was 10 feet, more or less, in length, and about 16 inches wide. The part of the map under the thread was closely scrutinized under a reading glass to see if the location was satisfactory as to details heretofore mentioned, such as houses, towns, ponds, etc. If the location, as projected, did not pass the requirements, the ends of the thread were shifted, or slight angles put in at certain points until the location passed requirements as far as possible. In this manner, long tangents were obtained with very slight angles. By studying the contact prints under a stereoscope, the location of fills for highways and railroad crossings, and also favorable crossings for small streams, could often be determined.

The advantage of aerial maps to the surveyors was the element of time saved. Final location was secured on the preliminary survey, as the features to be avoided could be easily seen at a glance. We estimate that, with a saving of 4 feet of main pipe line per mile by the use of the aerial maps, their cost was paid for. There is no doubt that the actual saving in length of line per mile is much more.



Specimen of the drafting department's contribution to the Panhandle Eastern Pipe Line Co.'s project. As many as 10 draftsmen were employed at one time, and this force in the course of the work turned out more than 1,000 individual drawings.

Spillway at foot of bridge—Louisburg compressor station dam.

Emergency gap in dam core-wall at Louisburg compressor station.

Considering the cost, accuracy, and convenience of this method of aerial mapping without the mosaic maps, the method was entirely satisfactory for the purpose. Several sections of mosaic maps were made and used, however, at important river crossings. This is thought possibly to have been the first attempt in the use of this form of aerial maps for pipe line location. It is reported that several other companies have since used this method with entire satisfaction.

Office Mapping

The drafting room personnel consisted of an office engineer and the draftsmen. The number of draftsmen varied at different periods, 10 being the largest number employed at one time. On account of the number of types of maps and drawings and the large number of each type required, the sizes were standardized as much as possible. Uniformity in type of lettering was secured by using lettering guides wherever possible.

Table No. 1 shows the main work done by the drafting room, although many other details were handled.

Special Engineering Designs

Mississippi River Crossing: One part of the construction requiring special engineering design was the crossing of the Mississippi River on the Champ Clark Highway Bridge at Louisiana, Mo. The total length of the bridge is 2279 feet, and consists of five truss spans of a total length of 1674 feet and deck girder spans 605 feet in total length.

In the agreement with the owners of the bridge, granting the privilege of constructing the pipe line on the bridge, the following provisions affected the design:

1. Solid welded construction to be used.
2. That part of the pipe passing over the R.R. tracks at the west end of the bridge to be provided with an outer casing.
3. Pipe to be suspended on the outside of the superstructure at or near the floor level in such manner that it will in no way interfere with, or impede traffic.
4. Design and construction to be such that the contraction and expansion strains shall not be transmitted to the bridge.
5. Pipe used in the crossing to have wall thickness at least 1/32 in. greater than that used in construction of the pipe line company's main line.
6. Final plans to be approved by engineers for the bridge owners.
7. The U. S. War Department regulations for overhead crossing of navigable streams to be complied with, which, in this case, was a clearance distance over the channel of 55 feet above standard low water.

Physical features of the bridge which had to be considered are as follows:

1. From the west approach to the end of the third truss span the grade of the bridge is 1.42 per cent down. At this point a break in grade occurs. To the east end of the bridge, the grade is 3.5 per cent down.
2. An offset of about 2 feet occurs where the deck girder meets the through truss.
3. Telephone wires are carried on a portion of the south side of the bridge.

The fact that the grade of the bridge is down all the way from west to east causes all the pipe to tend to creep toward the east end. To overcome this creeping effect, and to provide a fixed point from which contraction and expansion will take place in both directions, the pipe is anchored to the fixed end of the fourth truss span. This gives a length of pipe of 1232 feet east, and a length of pipe of 1025 feet west of the fixed point, subject to contraction and expansion. Considering a maximum temperature range of 140° F. (—20° F. to + 120° F.), the expansion and contraction to be provided for is calculated to be 12 inches for the west end, and 14½ inches for the east end. The annual temperature range of the pipe when gas is flowing through it will be approximately one-half the maximum temperature range. The maximum

TABLE NO. 1. PRINCIPAL WORK OF DRAFTING ROOM, ON PANHANDLE EASTERN PIPE LINE CO. PROJECT.

No. Made	Kind of Drawings	Scale	Size	Use
303	Location maps	1"—1000'	14"x30"	Right of way and construction
21	Index location maps	1"—2 mi.	14"x30"	General
1	System map	1"—8 mi.	3'x10'	Executives
39	Telephone maps	1"—½ mi.	14"x30"	Construction
10	Compressor station maps	1"—100'	14"x30"	Purchase of land and construction
16	Government permit applications		8½"x11"	Obtaining permits
24	River crossing plans	1"—100'	14"x30"	Construction
30	Meter and regulator sites	1"—100'	8½"x14"	Purchase of land
253	Highway and R.R. crossing applications	1"—100'	8½"x14"	Obtaining permits
5	Progress charts	1"—8 mi.	14"x30"	Executives and reports
64	Tax maps	1"—2 mi.	24"x24"	Tax department
32	Standard details of construction	Various	8½"x11"	Construction
75	Condemnation plats	1"—400'	8½"x14"	Legal proceedings
12	Operating maps	1"—½ mi.	12"x15"	Pipe line department
3	Gas field maps	1"—4 mi.		Land and production departments
119	Special drawings			Various
1007	Total			

and minimum temperatures of the pipe will be reached only if the gas ceases to flow in the pipe at the time the atmospheric temperatures are these maximum or minimum.

The movement of the pipe, due to temperature changes, is provided for at each end by an expansion "U" bend. The bend at the west end is suspended vertically, since the distance between the floor level of the bridge and the ground at this point will permit this. At the east end, the distance from the plane of the pipe to the natural ground is not sufficient to permit of vertical erection of the "U" bend; therefore, it is placed and supported in a horizontal position.

Dam for Lake at Compressor Station: Another feature requiring special engineering design was the matter of water supply for compressor stations. The possible sources of water supply for compressor station use are flowing streams, underground water from wells, and artificial lakes. At the location of the compressor station near Louisburg, Kan., the water must be provided by an artificial lake. Obtaining the supply from flowing streams was impracticable because of the distance from streams of sufficient continuous flow, and there is no underground fresh water supply in this vicinity.

After investigations had been made concerning its suitability for the construction of the station plant and a dam to form an artificial lake, a tract of land containing 80 acres was purchased for this compressor station site.

The water supply for the lake is derived entirely from rainfall run-off. Data affecting the design and construction of the dam are as follows:

Estimated Maximum Daily Consumption

Ten 1000 h.p. compressor units at 16 gal. per unit per minute	160 gal.
Three 190 h.p. auxiliary units at 3.5 gal. per unit per minute	10.5 gal.
Total estimated consumption per minute	170.5 gal.
Total estimated consumption per day (24 hrs.)	245,520 gal.

Water Supply

Drainage area (surveyed)	2350 acres
Slope of drainage area	1.5%
Drainage area cultivated	95%
Drainage area wooded	5%
Soil	Loam
Mean annual rainfall (1919 to 1929, incl.)	39.71 in.
Record rate of rainfall (in one hour)	4.74 in.
Estimated drouth period	100 days
Estimated evaporation 100-day drouth period	25 in.

Lake Data

Area of water surface at spillway elevation	24 acres
Capacity	40,397,000 gal.
Mean depth	5.2 ft.
Maximum depth	20.0 ft.
Evaporation during 100-day drouth period— 40 per cent of total capacity	16,000,000 gal.

Ordering and Handling of Material

Maps were prepared showing the location of the surveyed route of the pipe line, with reference to railroads and railroad stations. From these maps the stations to be used as shipping points were determined by inspection and scaling, giving due consideration to the distance of haul from the various stations to the pipe line location. An investigation of the unloading facilities at each railroad station was made to determine its suitability as a shipping point, and the amount of pipe, couplings, fittings, and paint to be shipped to each railroad station was then determined.

From this information a schedule was prepared showing shipping points, the name of the delivering railroad, and the amount of materials needed at each shipping point. The purchasing department of the pipe line company made up purchase orders from this schedule, furnishing us with three copies. Upon receiving these copies of purchase orders, they were checked with the schedule, and any discrepancies adjusted. One copy of the purchase order was retained in the office, and two copies sent to the material agents in the field. The length of the pipe line was divided into three districts, and each district was in charge of a material agent. Each district was divided into appropriate divisions.

Office copies of the purchase orders were filed in numerical order by stations, with a recapitulation sheet, which enabled the office material agent to check the materials as reported received by the district material agents.

Division material agents were furnished with tally sheets, checker's slips, material checking sheets, partial shipment reports, car reports, drafts, and office stationery. As each shipment of materials was made from the factory, the factory sent one copy of the bill of lading and one copy of the contents of car directly to the purchasing department of the pipe line company, and one copy to the division material agent.

The purchasing department, after making records of their own from the car contents sheet, turned them over to our office, and a tally was made which was compared with our division material agent's report. On shipments of pipe received, a tally was made showing date of shipment, car initial and number, and measured footage, which was totalled at the bottom of the sheet.

When tally sheets were received, the partial shipment report number was written on it, together with the footage as shown by the material agent. The total footage of pipe received was marked on the copy of the purchase order on file. When a purchase order was completed, the copy of the purchase order was taken from the open file and placed in a book file, together with all tally sheets pertaining to it in numerical order. Partial shipment reports were made in triplicate, one copy retained by the division material agent, and two copies, with freight bills attached, sent to the purchasing department of the pipe line company.

Upon the completion of a section of the pipe line, an inventory of all material left on hand was made by the division material agent and reported to this office. This material was turned over to, and receipted for, by representatives of the pipe line company.

Inspectors' daily reports, containing records of all materials used in the pipe line, were checked. The amount of material on hand and the amount of material used in the pipe line were then compared with the amount received, to determine the shortage, if any.

The duties of the division material agent are described briefly, as follows:

As the material agent was assigned his respective division, he was instructed to establish an office at a convenient point. With a list of the shipping points at hand, he made arrangements with the station agents at these points for notification of the arrival of material, receiving, and unloading. When the material agent was notified by the station agent of the arrival of material, he would notify the contractor, make a trip to the station, noting the date of arrival, car number, and contents, sending this information to the purchasing department of the pipe line company on the proper form.

Although freight was, in general, prepaid, the material agent was authorized to pay unpaid freight charges by issuing drafts on the pipe line company, making a report of the issuance of such drafts, with a copy of the draft, to the pipe line company.

Each joint of pipe was inspected for defects by the material agent or a checker as it was unloaded from the car, and each joint measured separately, the footage being put on a checker's slip. After being tallied and footed, the original checker's slip was signed by the contractor as received by him, which, together with any partial shipment report, was sent to our office. These pipe tallies were made in triplicate, the original being sent to this office, one given to the contractor, and one retained by the material agent.

The procedure for receiving couplings was handled in the manner described above. Paint and fittings, however, were tallied on a miscellaneous receiving slip.

After a car of materials had been checked and received, as above mentioned, either by a material agent or his

checker, the reports were checked in the division material office with the copy of the purchase order, and notations as to being a complete shipment or a partial shipment made.

If the shipment was incomplete, a partial shipment report was made. Information, as given on the partial shipment report, was put on one copy of the purchase order, which was retained until the shipment was completed, at which time it was handled as a complete order. Tally sheets and checker's slips contained a record of the amounts of material received, car numbers, division on which it was received, and the checker's name. Partial shipment reports contained the total number of pieces, total footage, car number and initial, amount of freight, order number, shipper, station at which received, and the account number. These reports were numbered consecutively, so they could all be accounted for.

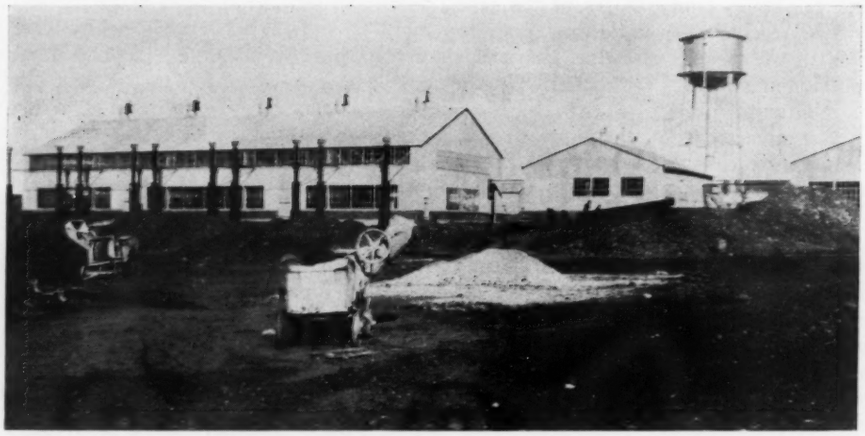
One copy of purchase order and one copy of all reports were retained in the division material office for future reference. In cases where material arrived at a shipping point a considerable time in advance of construction, the material agent made the necessary arrangements for storage.

Compressor Stations

Two of the compressor stations have been completed—one on the Cimarron River, 15 miles northeast of Liberal, Kan., and the other at Louisburg, Kan., about 40 miles south of Kansas City, Mo.

The buildings at each station consist of the following:

A main compressor building, 70 ft. wide by 140 ft. long; an auxiliary building, 38 ft. wide by 98 ft. long; a machine shop and warehouse building, 38 ft. wide by 70 ft. long; an office building, 25 ft. wide by 35 ft. long, and a garage building, 20 ft. wide by 80 ft. long. All buildings, with the exception of the office building, are constructed of structural steel frame, covered with galvanized iron on the roof and side walls. They are fitted with ventilating sash containing double strength glass in the upper half, and ribbed glass in the lower half. The main compressor building, auxiliary building, and machine shop have a wainscotting constructed of dark red, hard burned, face brick. Locker and wash rooms are located in the warehouse and machine shop building. The office building is of frame construction, the interior finished with plaster. The main engine room is fitted with crane rails and a 10-ton travelling crane, which is hand operated. The auxiliary building has trolley beams over the generator units and pump pit, which are fitted with 2-ton "I" beam trolleys, and one 2-ton chain hoist. The machine shop building has a crane rail extending into the main compressor building, which is fitted with "I" beam trolley and a 5-ton chain hoist.



General view of Louisburg compressor station.

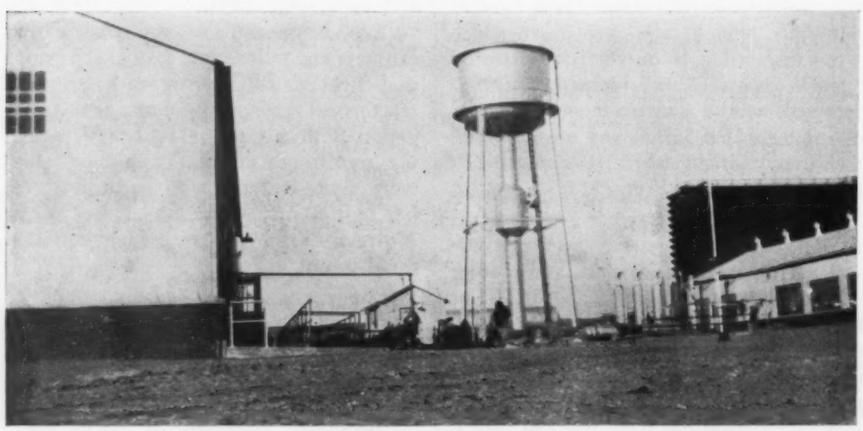
All buildings are heated from a central plant in the auxiliary building, the heat being furnished by a 125 h.p. water tube boiler operated at 100 lb. pressure.

The main compressor building is constructed with a concrete basement. The main compressor units are 1000 h.p., horizontal, twin tandem, double acting, 4 cycle, Cooper Bessemer gas engines, arranged to direct drive compressor cylinders from the front end of the engine bed face. The dimensions of the compressor cylinders are 13x36-in. To date four of these units have been installed at the Liberal station, and five at Louisburg. The auxiliary units at each plant consist of two 190 h.p. Cooper Bessemer, 3 cylinder, 4 cycle, vertical type gas engines, driving 156 K.V.A., 125 K.W. 80 per cent power factor generators with direct connected exciters. The generators are three-phase 60 cycle 400 volt. All engines were manufactured at the Mt. Vernon, Ohio, plant. General Electric motors are used for driving. The centrifugal circulating pumps are manufactured by Gould's Pumps, Inc., and the air compressors by the Worthington Pump and Machine Co.

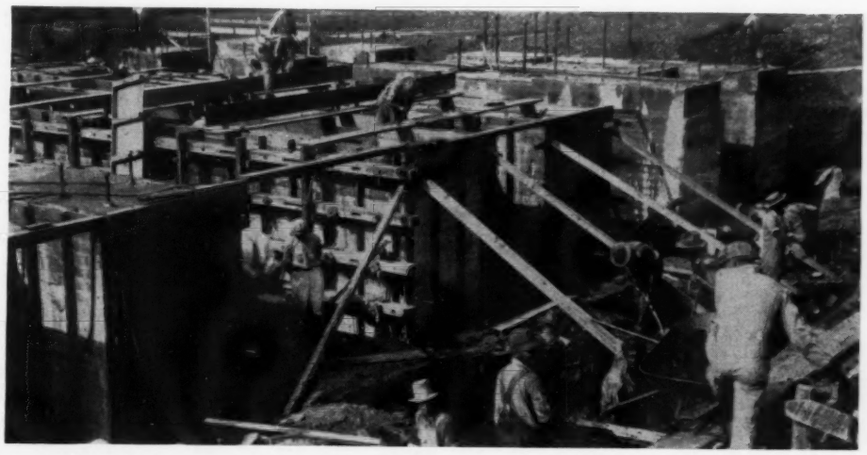
The machine shop is equipped with the following machinery:

1—16-in. Rockford Hy-Service shaper heavy duty with 3 h.p. G. E. motor.
1—U. S. electric 10-in. pedestal grinder with 1 h.p. G. E. motor.
1—13x60-in. bed South Bend precision lathe with ¾ h.p. G. E. reversing motor complete with attachments.
1—24x120-in. bed South Bend precision lathe with 3 h.p. G. E. reversing motor complete with attachments.
1—Racine 6x6-in. gravity feed power hacksaw with ½ h.p. G. E. motor.
1—Heavy duty drill, motor driven, with 24-in. table.

The cooling tower installed at the Liberal station is the Fluor type, consisting of 18 sections, Model No. XA15. The water supply at the Liberal station is obtained from four wells about 240 ft. deep. These wells are equipped with



Cimarron River compressor station, with water tower at center.



Engine bases at Cimarron River compressor station.

electric motor driven pumps, which are automatically operated. The water is pumped into a 50,000 gallon storage tank. This tank has a hemispherical bottom and conical top, erected on a 50 ft. steel substructure.

Both of these compressor stations were designed and constructed by the Fluor Corp., Ltd., under the direct supervision of G. T. Martin.

Line Construction

In table No. 2 will be found a general summary of pipe line construction, giving details of line sizes, distances, type of construction, etc. Table No. 3 presents data on pipe specifications.

Main line gate valves were placed at the most accessible points, spaced approximately 8 miles apart. They were semi-steel body, bronze mounted, 500 lbs., G. W. P., 1000 lbs. test. The flanges used with these valves were all extra heavy, forged steel flanges. Smaller valves used were Wescott type. Couplings used on the main line were fitted with a 7x⅜-in. center ring and Paranite "C" rubbers.

Paint used for protection of the main line pipe was Wailes Dove Herniston Bitumastic, high melting point, low penetration, XXH, coal tar base enamel; also a high melting point biturine enamel and an asphalt chromate emulsion.

Inspection

For convenience in the organization of the inspection forces, the pipe line was divided into three divisions of approximately equal length, called the Western, Central, and Eastern Divisions. A description of the inspection methods and construction methods of the Western Division, which is typical of the other divisions, follows:

The inspection organization of a division consisted of the division inspector, with his necessary clerical help, and inspection crews, the number of crews depending on the number of construction gangs at work. Each inspection gang consisted of a pipe inspector, ditch inspector, wrench or coupling inspector, paint inspector, lowering-in inspector, and a welding inspector. The pipe inspector of each crew was the senior inspector of his force, and was responsible for the efficiency of the other five inspectors in his crew.

Each crew of inspectors required two automobiles. One was used by the paint inspector, who was usually working several miles ahead of the laying gangs. The other was used by the balance of the inspectors under the direction of the pipe inspector.

The ditch inspector supervised all right of way clearing, fence building, backfilling, and clean-up. Pipe laying and line-up, highway and railroad crossings, gate valve settings, bending, weighting of line, creek crossings, and installation of drips, syphons, taps, meter settings, and casing installation were supervised by the pipe inspector.

The alignment and tightness of all couplings were tested by the wrench or coupling inspector. The lowering inspector supervised the painting of couplings, lowering-in of the pipe, and covering of the pipe line at night. The paint inspector was responsible for the cleaning of pipe, the application of the priming coat, application of the enamel

(Continued on Page 66)

TABLE NO. 2. GENERAL SUMMARY OF PIPE LINE CONSTRUCTION TO DATE.

Section of Line	Contractor	Size Line, Inches	Distance, Miles	Type of Construction	Date of Beginning	Date of Completion
Oil City, Tex., to Liberal, Kan.	Oklahoma Contracting Co.	22	108	Welded with coupling every third joint	5-12-30	9-30-30
Liberal, Kan., to Newton, Kan.	Oklahoma Contracting Co.	24	198	All coupled	8-6-30	1-23-31
Newton, Kan., to Louisburg, Kan.	Williams Bros., Inc.	24	154	All coupled	7-11-30	1-8-31
Louisburg, Kan., to Boonville, Mo.	Connor & Son	22	107	Welded with coupling every third joint	5-22-30	1-10-31
Boonville, Mo., to Louisiana, Mo.	Williams Bros., Inc.	22	99	Welded with coupling every third joint	7-21-30	1-12-31
Hugoton field line	Jones & Brooks	16	35	All welded	10-25-30	1-4-31
Texas gathering lines	Williams Bros., Inc.	20, 18, 16 12, 10	57	All welded	7-4-30	12-12-30
Mildred, Kan., lateral	Connor & Son	8	31	All welded	1-7-31	3-1-31
Missouri laterals	Southwestern Constructing Co.	6, 8	70	All welded	11-22-30	
Texas well lines	Benson & Henderson	4, 6, 8	29	All welded	11-15-30	2-1-31
Jefferson City lateral	Oklahoma Contracting Co.	8	43	All welded	12-12-30	2-5-31
TOTAL MILES LAID TO DATE			930			

TABLE NO. 3. PIPE SPECIFICATIONS

Size O. D. (Inches)	Nominal Wall Thickness (In.)	Weight (Lbs./Ft.)	Minitensile Strength (Lbs.)	Type of Weld	Length (Feet)
24	5/16	79.060	60,000	Electric	Double Random 40
22	5/16	72.383	50,000	Lap	Single Random 20
22	11/32	79.506	50,000	Lap	Single Random 20
20	5/16	65.708	50,000	Lap	Single Random 20
16	9/32	47.669	50,000	Lap	Single Random 20
12¾	¼	34.552		Lap	Single Random 20
*10¾	11/32	40.483		Lap	Double Random 40
8⅝	¼	22.361		Lap	Single Random 20
6⅝	¼	17.021		Lap	Single Random 20

All pipe plain end, beveled 45° for welding.
*Used for River Crossings.

Companies Furnishing Pipe	Mills Where Pipe Was Rolled
National Tube Co.	Christy Park, Penn.; Lorain, Ohio; Gary, Ind.; McKeesport, Penn.
Spang Chalfant Co.	Economy, Penn.; Etna, Penn.
Youngstown Sheet & Tube Co.	Youngstown, Ohio; Indiana Harbor, Ind.
Jones & Laughlin Co.	Aliquippi, Penn.

New Gas Service Area

A 1930—1931 SURVEY

KEEPING step with the expansion of natural gas transmission line construction, service area has increased in proportion to the miles of pipe laid during the past year, with a corresponding impetus to new meter and service installations, distribution system construction, and appliance sales promotion in virgin territory.

As revealed by companies reporting in the following survey of new gas towns in Western America, 386 communities received natural gas in 1930, as compared with the 290 shown in the 1929 survey. To date in 1931, natural gas service has been given to 73 more. Towns changed over from manufactured to natural gas are not included in this survey. It is estimated that close to 50 distribution systems serving manufactured gas at the beginning of last year are now serving "natural."

Along with projected transmission line construction, franchising activity gives promise of bringing service in 1931-32 to another large group of new gas towns. The June issue of this publication will carry a tabulation of franchises granted to date in towns where natural gas service has not yet begun. Companies participating in the survey reported 106 towns of this classification.

The towns listed below are all being newly served, in most cases with natural gas though several manufactured gas service extensions are covered. In the "Butane-Propane News" department of this issue, appears a list of communities now receiving or about to receive some form of liquefied petroleum gas service.

Service Begun 1930

Company Town	Population
ARKANSAS	
Arkansas Natural Gas Corporation	
Ashdown	1,607
Dardanelle	1,832
England	2,130
Lonoke	1,674
Carlisle	907
Wilmar	627
Star City	932
Monticello	2,378
Warren	2,145
Hamburg	1,517
Arkansas Power & Light Co.	
Jonesboro	15,000
Newport	5,000
Tuckerman	1,178
Walnut Ridge	4,000
Searcy	5,000
Kensett	1,000
Hoxie	2,000
Batesville	6,000
Swifton	1,000
Southwestern States Gas Co.	
Greenwood	1,200
Arkansas Western Gas Co.	
Fayetteville	5,000
Springdale	2,000
Rogers	4,000
Bentonville	2,000
Gentry	700
Siloam Springs	3,000
Elkins	
Lowell	
CALIFORNIA	
Coast Counties Gas and Electric Co.	
Los Banos	2,000
Gustine	1,000
Dos Palos	600
S. Dos Palos	100
Brentwood	500
Walnut Creek	1,100
Morgan Hill	700
San Juan	700
Aromas	200
San Martin	275
Bay Point	1,500
Pacific Gas and Electric Co.	
Agua Caliente	
Alvarado	1,120
Boyes Springs	1,000
Broderick	800
Calistoga	1,000
Carmel	2,000
Ceres	1,100
Dixon	990
Easton	
Elk Grove	1,450
El Verano	500
Florin	1,400
French Camp	200
Fulton	
Galt	1,000
Glen Ellen	1,200
Healdsburg	2,296
Hughson	625
Livermore	2,800
Manteca	1,600
Mission San Jose	500
Newman	1,270
Oakville	
Ora Vista	
Patterson	903
Pleasanton	1,400
Ripon	1,000
Rutherford	
Salida	300
Shellville	200
Sonoma	980
St. He'ena	1,580
Sunol	500
Thornton	135
Vineburg	250
Warm Springs	300
Windsor	600
Yountville	500
***San Diego Consolidated Gas & Electric Co.**	
El Cajon	3,200
* Manufactured Gas.	
Santa Maria Gas Co.	
Garden Farms	
Templeton	
Southern California Gas Co.	
Corcoran	1,761
Delano	2,612
McFarland	500
Palm Springs	1,433
Riverdale	400
Shafter	395
Wasco	1,581
West Side Natural Gas Co.	
Avenal	210
Kettleman City	150
CANADA	
Canadian Western Natural Gas, Light, Heat and Power Co.	
Foremost, Alberta	250
Burdett, Alberta	100
Cayley, Alberta	125
Black Diamond, Alberta	1,000
COLORADO	
Arkansas Valley Gas Co.	
Las Animas	
Public Service Co. of Colorado	
Golden	2,729
Loveland	5,463
Wheatridge	500
Mountair	500
Johnstown	759
Lakewood	100
IOWA	
Iowa Railway and Light Corp.,	
Mount Vernon	1,499
Lisbon	843
KANSAS	
Central Kansas Gas Co.	
Hays	5,350
Ellis County Gas Co.	
Ellis	1,900
Gas Service Co.	
Barnard	416
Beloit	3,502
Cawker City	739
Downs	1,383
Ellsworth	2,072
Esbon	319
Everest	105
Glen Elder	534
Hamlin	183
Hiawatha	3,302
Holton	2,705
Horton	4,100
Huron	149
Jewell	707
Kanapolis	860
Lebanon	723
Lincoln Center	1,732
Lucas	630
Luray	464
Fairview	367
Formosa	381
Mankato	1,404
Minneapolis	1,741
Morrill	519
Osborne	1,881
Reserve	197
Sabetha	2,332
Smith Center	1,736
Welbourne	519
Geneseo	536
Montrose	131
Sylvan Grove	558
General Utilities Co.	
Peabody	1,600
Florence	1,600
Hillsboro	1,600
Ramona	325
Tampa	300
Lost Springs	275
Lincolnville	200
Pilsen	150
Aulne	200
White City	650
Eudora	650
De Soto	450
Lake of Forest	400
Wilder	150
Kansas Pipe Line and Gas Co.	
Clifton	713
Gypsum	638
Canton	728
Galva	358
Buhler	520
Concordia	5,792
Belleville	2,383
Clyde	1,174
Moundridge	870
Medicine Lodge	1,655
Morganville	281
Pretty Prairie	429
Cuba	430
Wamego	1,647
St. Marys	1,304
Minden	205
Marysville	4,013
Seneca	1,864
Frankfort	1,346
Hanover	880
Washington	1,370
Kingman County Gas Co.	
Kingman	2,752
Missouri-Valley Pipe Line Co.	
Garden City	4,100
Peoples Gas Co.	
Greensburg	1,338
Stafford	1,614
St. John	1,552
Union Gas Corp.	
Le Roy	875
LOUISIANA	
Louisiana Power & Light Co.	
Lake Providence	2,867
Oak Grove	1,241
Epps	30
Delhi	1,043
Tallulah	3,332
New Orleans Public Service, Inc.	
Forest Park	
Pineville Gas Co., Inc.	
Standard	500
Sabine Gas Co.	
Zwolle	1,264
Many	1,239
Southern Cities Distributing Co.	
Bernice	965
Dubach	608
Ringgold	618
MISSOURI	
Gas Service Co.	
Aurora	3,876
Billings	470
Marionville	1,227
Monett	4,710
Nevada	7,448
Pierce City	1,300
Republic	875
Warrensburg	5,100
Montrose	131
General Utilities Co.	
Liberty	3,600
Avondale	
Moscow	
Coomber Terrace	

Company Town	Population
Winnwood	
Winnetonka	
Maple Hill	
Maple Park	
Claycoma	
Ravena	
Hymer	3500
Interurban Heights	
White Hall Fields	
Jewel Ridge	

MONTANA

Bowdoin Utilities Co.	
Glasgow	2,215
Malta	1,265
Hinsdale	420
Saco	506
Cut Bank Gas Utilities Co.	
Cut Bank	840
Montana-Dakota Power Co.	
Fairview	576
Sidney	2,009
Savage	320
Montana-Dakota Utilities Co.	
Wibaux	616
Carlyle	36

NEBRASKA

Gas Service Co.	
Superior	2,800
Falls City	5,000
Iowa Nebraska Light & Power Co.	
Aurora	2,712
Bee	228
Bradshaw	340
Clatonia	342
Cortland	322
Crete	2,865
David City	2,333
De Witt	623
Dorchester	579
Exeter	941
Fairmont	735
Friend	1,263
Hallam	212
Hampton	369
Milford	832
Osceola	1,209
Plymouth	453
Rising City	472
Seward	2,742
Shelby	628
Staplehurst	254
Stromsburg	1,361
Ulysses	460
Wahoo	2,689
Wilbur	1,352
Missouri Valley Pipe Line Co.	
*Auburn	3,068
*Humboldt	1,435
*Pawnee City	1,573
*Sterling	702
*Tecumseh	1,829
*Beatrice	9,664
*Lincoln	63,600
*Plattsmouth	4,200

* Gas delivered at city gate; franchise not owned.

NEW MEXICO

Pecos Valley Gas Co.	
Lake Arthur	400
Dexter	500
Southern Union Gas Co.	
Tucumcari	4,143
Portales	2,519
Farmington	1,350

NORTH DAKOTA

Montana-Dakota Utilities Co.	
Golva	50
Sentinel Butte	300
Belfield	495
Dickinson	5,021
Gladstone	363
Glen Ullin	949
Hebron	1,300
Mandan	5,010
New Salem	786
Richardson	703
Taylor	250
Beach	1,264
Montana-Dakota Power Co.	
Williston	4,965
Bowman	881
Rhame	290

Company Town	Population
OKLAHOMA	
Capital Gas Co.	
Lockhoma	
Moore	538
Community Natural Gas Co.	
Caddo	933
Hastings	379
D. & O. Utilities Co.	
Duke	
Olustee	
Oklahoma General Gas Co. & Pioneer Gas Utilities Co.	
Choctaw	
Harrah	
McLoud	
Nicoma Park	
Nichols Hills	
Oklahoma Natural Gas Corp.	
Checotah	
Eufalua	
Warner	
Pact Gas Co.	
Agra	
Coyle	
Public Service Co. of Oklahoma	
Krebs	2,385
Public Service Corp. of Texas	
Fargo	
Supply	
Southwest Gas Utilities Corp. of Oklahoma	
Allen	2,000
Killarney Hills	300
North Seminole	500
Spiro Gas Co.	
Spiro	
Standard Gas Co.	
Madill	2,203
Tishomingo	1.281
State Fuel Supply Co.	
Gotebo	400
Verden	750

OREGON

***Portland Gas and Coke Co.**	
West Salem	974
Rickreall	248
Dallas	2,975
Monmouth	906
Independence	1,248
Albany	5,325
Corvallis	7,585
Woodburn	3,000
Gowars	400
Brooks	200
Lebanon	1,851
Mt. Angel	979
Silverton	2,462

* Manufactured gas.

TEXAS

Amarillo Gas Co.	
Amarillo	
Community Natural Gas Co.	
Allen	750
Blossom	1,200
Buffalo Gap	500
Enloe	450
Iredell	750
Lawn	650
Melissa	500
Ovalo	400
Pecan Gap	500
Scurry	500
Streetman	800
Tehuacana	750
Tuscola	500
Dalhart Gas Co..	
Hartley	200
Rio Grande Valley Gas Co.	
Raymondville	2,050
Southern Cities Distributing Co.	
Pittsburg	
Mt. Pleasant	
Mt. Vernon	
Avinger	
Gilmer	
Daingerfield	
Jefferson	
Hughes Springs	
Naples	

Company Town	Population
Linden	
Omaha	
Winnsboro	
Southern Union Gas Co.	
Columbus	3,191
Eagle Lake	2,100
Seally	2,000
Navisota	5,000
Texas Gas Utilities Co.	
Del Rio	11,693
Eagle Pass	5,059
Piedras Negras (Mexico)	
Carrizo Springs	
West Texas Gas Co.	
Littlefield	3,218
Amherst	1,000
Sudan	1,014
Anton	389
Shallowater	200
Levelland	1,650
Muleshoe	779
Friona	200
Bovina	150
Dimmitt	830
Petersburg	548
Turkey	975
Silverton	873
Quitaque	945
Bowes	
Roundup	
Yellow	
James	
Hurley	
Brownfield	1,907
Lahey	
Wellman	
Seagraves	

UTAH

Morgan	1,000
Clearfield	500
Magna	3,500

WASHINGTON

Northwestern Natural Gas Co.	
Grandview	1,007
Prosser	1,600
Mabton	650
Sunnyside	2,200
***Seattle Gas Co.**	
Lake City	1,298
Riverton Heights	843
Arbor Heights	564
***Washington Gas and Electric Co.**	
Sumner	1,967
Auburn	3,906
***Western Gas Co. of Washington**	
Longview	10,000
Kelso	8,000

* Manufactured gas.

WYOMING

New York Oil Co.	
Fort Washakie	65
Northwest States Utilities Co.	
Sheridan	8,436
Buffalo	1,748

Service Begun 1931

CALIFORNIA

Coast Counties Gas and Electric Co.	
Danville	750
Clyde	100
Nichols	100
***San Diego Consolidated Gas and Electric Co.**	
Del Mar	647
Solana Beach	547
Cardiff	450
Encinitas	850
Leucadia	613

* Manufactured gas. Purchased plant.

COLORADO

Public Service Co. of Colorado	
Longmont	6,025
Aurora	2,259

KANSAS

Gas Service Co.	
Montrose	131
Kansas Pipe Line and Gas Co.	
St. George	216
Marquette	714
Blue Rapids	1,465
Waterville	698
Beattie	434
Axtell	607
Irving	356
Baileyville	125
Strong City Gas Co.	
Florence	1,400
Cedar Point	500
Hillsboro	2,200

LOUISIANA

Pineville Gas Co., Inc.	
Tioga	400

MISSOURI

Bowling Green Gas Co.	
Bowling Green	1,855
Gas Service Co.	
Knobnoster	683
LaMonte	515
Carrollton	4,058
Sweet Springs	1,641
Concordia	1,140
General Utilities Co.	
Smithville	800
Armory	
Nashua	
Ashland	
Linden	
Oak Park	
Paradise	
Plattsburg	2,000

OKLAHOMA

H. G. Newcomb Co.	
Indianola	378
Pact Gas Co.	
Coyle	
Langston	
State Fuel Supply Co.	
Laverne	960

OREGON

***Portland Gas and Coke Co.**	
Sherwood	1,300
Middleton	51

* Manufactured gas.

TEXAS

Houston Pipe Line Co.	
Skidmore	
Texas Gas Utilities Co.	
Uvalde	
La Pryor	
United Gas Public Service Co.	
Huntsville	5,028
Groveton	1,046
Crockett	4,441
Grapeland	1,027
Elkhart	
Lovelady	502
Trinity	2,036
Elgin	1,823
Butler	
Bastrop	1,895
Smithville	3,296
Giddings	1,835
La Grange	2,354
Weimar	1,256
Hallettsville	1,406
Tenaha	
West Texas Gas Co.	
Seagraves	505
Seminole	500

WASHINGTON

***Seattle Gas Co.**	
North Riverton	250
Duwamish	940
Riverton	655
Foster	603
Tuckwila	424
Orrillia	1,023
Kent	2,321
Renton Junction	100

* Manufactured gas.

Western Gas Company of Washington	
Bremerton	10,000

Pacific Coast Gas Association

Managing Director: Clifford Johnstone

Association Headquarters: 447 Sutter St., San Francisco

President: R. E. Fisher

Vice-President, Pacific Gas and Electric Co., San Francisco

Northwest Regional Meeting, June 11-12

PRESIDENT R. E. Fisher, with the cooperation of Section chairmen, has been busy during the past few weeks with the preparation of a program for the Northwest Regional Conference at Tacoma which will without question make it one of the most inspiring meetings ever held by the Association.

The Conference will take place at the Tacoma Hotel on June 11 and 12. At this time of year the Pacific Northwest is at its best and it is expected that a number of Californians will attend the Conference preliminary to vacationing in the wonderful Puget Sound district.

Programs will be mailed about May 25 and in the meantime it will be in order for all those planning to attend the Conference to make reservations at the Tacoma Hotel, mentioning, of course, their attendance at the Gas Association Conference.

1931 Committee Work in Final Stages

COMMITTEES of the Pacific Coast Gas Association are now putting the final touches to the reports which will close the 1931 committee program.

The early date of the Convention this year makes it necessary to carry all reports and papers which are to be printed in advance of the Convention in the August issue of *Western Gas* instead of the September issue, as has been customary for a number of years. The Section Chairmen, therefore, have issued instructions to all committees to have their reports completed as soon after May 1st as possible, so that time will be available for the vast amount of editing, copying and preparation incident to printing.

Those working on the Association's committees make up an honor roll which contributes a great deal each year to the knowledge of the gas industry. Those who are carrying the banner this year are listed below:

ACCOUNTING SECTION

R. A. Hornby, General Chairman, Pacific Lighting Corp.
Geo. F. Mackenzie, Vice-Chairman, Portland Gas & Coke Co.
C. D. Cushman, Vice-Chairman, Los Angeles Gas & Electric Corp.

Special Problems in Customers' Accounting

E. R. Merrill, Chairman, Portland Gas & Coke Co.
R. J. Fabel, Tucson Gas, Electric Light & Power Co.
L. E. Green, Los Angeles Gas & Electric Corp.
T. R. Hoag, Spokane Gas & Fuel Co.
C. T. Krymer, San Diego Consolidated Gas & Electric Co.
J. W. Malone, British Columbia Electric Railway Co., Ltd.
Wm. O. Mulligan, Southern California Gas Co.
Geo. C. Schiesberg, Southern Counties Gas Co.

Special Problems in Stores Accounting

Wm. Giese, Chairman, Southern Counties Gas Co.
A. A. Charannat, Pacific Gas & Electric Co.
C. W. Cropp, British Columbia Electric Railway Co., Ltd.
H. Gibbs, Southern California Gas Co.
J. G. Hawkins, Portland Gas & Coke Co.
Wm. Maddock, Los Angeles Gas & Electric Corp.
L. H. Prentiss, Tucson Gas, Elec. Light & Power Co.
J. L. Rometch, Spokane Gas & Fuel Co.
John Zimbleman, San Diego Consolidated Gas & Electric Co.

Destruction of Records

A. T. Kelly, Chairman, Pacific Gas & Electric Co.
N. H. Bradshaw, Los Angeles Gas & Electric Corp.
W. E. Cook, Spokane Gas & Fuel Co.
G. A. Detrick, Southern California Gas Co.
C. A. Isbell, Southern Counties Gas Co.

Fixed Capital Records

R. W. Baily, Chairman, Southern California Gas Co.
M. E. Bauman, Los Angeles Gas & Electric Corp.
C. S. Hall, San Diego Consolidated Gas & Electric Co.
C. A. Honey, Southern Counties Gas Co.
H. Painter, Tucson Gas, Electric Light & Power Co.

Haulage Accounting

Geo. F. Mackenzie, Chairman, Portland Gas & Coke Co.
A. B. Cates, Southern California Gas Co.
Frank W. Keller, San Diego Consolidated Gas & Electric Co.
A. S. MacDougall, Los Angeles Gas & Electric Corp.
N. R. McKee, Southern Counties Gas Co.
C. E. Neiderer, Portland Gas & Coke Co.
A. Shackelford, Tucson Gas, Electric Light & Power Co.

Classification of Accounts for Natural Gas Properties

E. N. Simmons, Chairman, Los Angeles Gas & Electric Corp.
A. B. Carpenter, San Joaquin Light & Power Co.
G. A. Detrick, Southern California Gas Co.
D. G. Martin, Pacific Gas & Electric Co.
W. J. McCoy, Southern Counties Gas Co.
D. McCullough, Standard Management & Operating Corp.
C. W. Platt, Portland Gas & Coke Co.

Customers' Credit Plan—General Order 58

O. L. Moore, Chairman, Los Angeles Gas & Electric Corp.
D. G. Martin, Vice-Chairman, Pacific Gas & Electric Co.

Division Purchases and Disbursements

Paper by J. O. Ewing, Southern California Gas Co.
Paper by D. G. Martin, Pacific Gas & Electric Co.

COMMERCIAL SECTION

H. M. Crawford, General Chairman, Pacific Gas & Electric Co.

Domestic Sales

F. M. Banks, Chairman, Southern California Gas Co.
Each member of this Committee will report on a specific subject as follows:
Merchandising Campaigns: H. E. Davidson, Southern California Gas Co.
Sales Education: L. F. Galbraith, Pacific Gas & Electric Co.
Merchandising Plans and Policies: Pierre Vinet, Coast Counties Gas & Electric Co.
Market Analysis and Survey: A. P. Stryker, Pacific Gas & Electric Co.
House Heating Sales: F. U. Naylor, Pacific Gas & Electric Co.

Industrial Sales

C. R. Miller, Chairman, Portland Gas & Coke Co.
Mr. Miller has established a mailing list of all industrial gas engineers who are members of the Association and will institute an information service on gas utilization. The editorial committee is as follows:
L. C. Haffner, Chairman, Portland Gas & Coke Co.
J. H. Gumz, Pacific Gas & Electric Co.
Chas. T. Ferry, Southern Counties Gas Co.

PUBLIC RELATIONS SECTION

Geo. L. Myers, General Chairman, Portland Gas & Coke Co.

Employees Relations With the Industry

B. H. Parkinson, Chairman, Portland Gas & Coke Co.
E. G. McCann, Pacific Gas & Electric Co.
C. F. Stanley, Los Angeles Gas & Electric Corp.

Employees Relations With the Public

E. M. Seel, Chairman, Pacific Gas & Electric Co.

Director of Stunts Presentations—Al C. Joy, Pacific Gas & Electric Co.
Assistant Director for Northern Region—Geo. Mackenzie, Portland Gas & Coke Co.
Assistant Director for Central Region—D. J. Bartelme, Pacific Gas & Electric Co.
Assistant Director for Southern Region—L. H. Dell, Southern California Gas Co.

Customers' Relations

O. L. Moore, Chairman, Los Angeles Gas & Electric Corp.

Customer Ownership

E. C. Cox, Chairman, Southern Counties Gas Co.

Women's Committee

Clarita Scott, Chairman, Los Angeles Gas & Electric Corp.

Educational Committee

D. L. Scott, Chairman, Los Angeles Gas & Electric Corp.

PUBLICITY AND ADVERTISING SECTION

W. D. Thurber, General Chairman, Southern Counties Gas Co.

Advertising Policies, Practices and Costs

F. M. Banks, Chairman, Southern California Gas Co.

Special News Service

Al C. Joy, Chairman, Pacific Gas & Electric Co.

Advertising Exchange

A. A. Salmon, Chairman, Spokane Gas & Fuel Co.

Institutional Advertising

J. F. Pollard, Chairman, Seattle Gas Co.

Advertising Exhibits

J. Charles Jordan, Chairman, Pacific Gas & Electric Co.

Evaluations of Advertising

H. L. Masser, Chairman, Los Angeles Gas & Electric Corp.

TECHNICAL SECTION

W. M. Henderson, General Chairman, Los Angeles Gas & Electric Corp.
J. S. Holt, Vice-Chairman, Seattle Gas Co.
W. Frank Pape, Vice-Chairman, Pacific Gas & Electric Co.

PRODUCTION COMMITTEE

N. H. Wardale, Chairman, Portland Gas & Coke Co.

Plant Fire Protection and Housekeeping

J. E. Kelley, Chairman, Pacific Gas & Electric Co.
C. M. Cole, Southern California Gas Co.
B. G. Dick, Portland Gas & Coke Co.
V. R. Hughes, Pacific Gas & Electric Co.
J. M. North, Los Angeles Gas & Electric Co.
H. M. Thomas, Northwest Cities Gas Co.
C. H. Wilcox, Los Angeles Gas & Electric Corp.

Corrosion of Gas Plant Equipment

B. G. Dick, Chairman, Portland Gas & Coke Co.
E. Haviland, Seattle Gas Co.
B. W. Mueller, San Francisco.
R. T. Richards, Central Arizona Light & Power Co.
W. R. Shettel, Los Angeles Gas & Electric Corp.
O. L. Wrestler, Los Angeles Gas & Electric Corp.

Water Gas Development

W. R. Alexander, Chairman, Seattle Gas Co.
R. A. Hoffman, Spokane Gas & Fuel Co.
C. P. Johnson, Puget Sound Power & Light Co.
John Keillor, British Columbia Electric Railway Co., Ltd.
J. F. Sauer, Pacific Gas & Electric Co.
H. M. Thomas, Northwest Cities Gas Co.

Butane for Peak Load Production

J. A. Harritt, Chairman, San Diego Consolidated Gas & Electric Co.
F. M. Cota, San Diego Consolidated Gas & Electric Co.
J. F. Deusler, Louisville Gas & Electric Co.
Chas. Grunsky, Standard Management & Operating Corp.
F. S. Honberger, Southern California Gas Co.
Chas. E. McCartney, Petrolane, Ltd.
C. H. Webber, Tucson Gas, Electric Light & Power Co.

Economics of Sulphur Removal

M. T. Burton, Chairman, Southern California Gas Co.
D. S. Kelleway, Portland Gas & Coke Co.
J. M. North, Los Angeles Gas & Electric Corp.
C. A. Renz, Los Angeles Gas & Electric Corp.
S. C. Schwarz, Portland Gas & Coke Co.
N. K. Senatoroff, Los Angeles Gas & Electric Corp.

Instruments Used in Manufacturing Gas

J. K. Lehman, Chairman, Portland Gas & Coke Co.
B. O. Cossey, Los Angeles Gas & Electric Corp
F. M. Cota, San Diego Consolidated Gas & Electric Co.
J. E. Kelley, Pacific Gas & Electric Co.

NATURAL GAS TRANSMISSION COMMITTEE

Elting Henderson, Chairman, Southern California Gas Co.

Compressor Stations

S. S. Donaldson, Chairman, Southern California Gas Co.
Frank Driggers, Ventura Fuel Co.
B. E. Embry, Southern California Gas Co.
C. F. Maybee, Southern Counties Gas Co.
J. W. Reed, Cooper-Bessemer Corp.

Measurement

A. R. Bailey, Chairman, Coast Counties Gas & Electric Co.
H. M. Crawford, Los Angeles Gas & Electric Corp.
C. H. Fulcher, Pacific Meter Works.
H. A. Hurley, Southern California Gas Co.
J. R. McLaughlin, Southern Counties Gas Co.
H. V. Powell, Ventura Fuel Co.
R. M. Stewart, Pacific Gas & Electric Co.
F. H. Winslow, Southern Counties Gas Co.

Transmission

C. W. Beck, Chairman, Los Angeles Gas & Electric Corp.
R. M. Bauer, Southern California Gas Co.
M. J. Cereghino, Los Angeles Gas & Electric Corp.
R. L. Cook, Southern California Gas Co.
G. L. Corfield, Los Angeles Gas & Electric Corp.
L. P. W. Des Brisay, Los Angeles Gas & Electric Corp.
H. S. Harris, Los Angeles Gas & Electric Corp.
B. M. Laulhere, Southern California Gas Co.
N. L. Hoff, Los Angeles Gas & Electric Corp.
F. E. Jinnette, Ventura Fuel Co.
E. H. Mohr, Los Angeles Gas & Electric Corp.
Carl Summers, Southern Counties Gas Co.

DISTRIBUTION COMMITTEE

D. H. Ferkins, Chairman, San Diego Consolidated Gas & Electric Co.

Distribution Design

Norman L. Hoff, Chairman, Los Angeles Gas & Electric Corp.
E. G. Campbell, Pacific Gas & Electric Co.
D. B. Larson, Portland Gas & Coke Co.
E. H. Mohr, Los Angeles Gas & Electric Corp.
Frank Sauer, Seattle Gas Co.

Meters and Meter Statistics

Harold M. Crawford, Chairman, Los Angeles Gas & Electric Corp.
A. R. Bailey, Coast Counties Gas & Electric Co.
Dan Barnes, Seattle Gas Co.
F. H. Coble, Southern California Gas Co.
W. H. Davis, Pittsburg Equitable Meter Co.
D. E. Farmer, Portland Gas & Coke Co.
Otto Goldkamp, San Diego Consolidated Gas & Electric Co.
W. A. Laviolette, Pacific Gas & Electric Co.
B. F. McBurney, Southern Counties Gas Co.
E. H. Roseberry, Sprague Meter Co.
R. M. Stewart, Pacific Gas & Electric Co.
K. C. Tomlinson, Pacific Meter Works.
F. H. Winslow, Southern Counties Gas Co.

Governor and Regulator Capacites

H. S. Harris, Chairman, Los Angeles Gas & Electric Corp.
A. R. Bailey, Coast Counties Gas & Electric Co.
E. G. Campbell, Pacific Gas & Electric Co.
J. E. C. Currens, Pacific Gas & Electric Co.
F. English, Pacific Gas & Electric Co.
Otto Goldkamp, San Diego Consolidated Gas & Electric Co.
D. S. Kelleway, Portland Gas & Coke Co.
V. J. Robbins, Los Angeles Gas & Electric Corp.
R. M. Stewart, Pacific Gas & Electric Co.
F. H. Winslow, Southern Counties Gas Co.

Pipe Protection

Guy Corfield, Chairman, Los Angeles Gas & Electric Corp.
A. B. Allyne, Southern Counties Gas Co.
M. T. Burton, Southern California Gas Co.
R. H. Hargreaves, Pacific Gas & Electric Co.
V. W. Harper, Portland Gas & Coke Co.
T. J. Hawley, Central Arizona Light & Power Co.
R. C. Terradell, Los Angeles Gas & Electric Corp.
M. E. Waite, San Diego Consolidated Gas & Electric Co.
J. H. Wharmby, British Columbia Electric Railway Co., Ltd.
O. L. Wrestler, Los Angeles Gas & Electric Corp.

Construction Equipment Tests of Performance

C. D. Weiss, Chairman, San Diego Consolidated Gas & Electric Co.
H. V. Buffington, Los Angeles Gas & Electric Corp.
C. M. Cole, Southern California Gas Co.
G. F. Cruickshank, Southern Counties Gas Co.
A. E. Englebright, Pacific Gas & Electric Co.
A. E. Hall, Standard Management & Operating Corp.
V. W. Harper, Portland Gas & Coke Co.
T. J. Hawley, Central Arizona Light & Power Co.
F. S. Honberger, Southern California Gas Co.
B. M. Laulhere, Southern California Gas Co.
A. B. Meyer, Southern California Gas Co.
F. P. Minton, Los Angeles Gas & Electric Corp.
J. R. Ott, Southern Counties Gas Co.
W. F. Pape, Pacific Gas & Electric Co.
Frank Sauer, Seattle Gas Co.

Public Relations Stunts Presentation

GEO. L. MYERS, chairman of the Public Relations Section, announces that the executive committee of the Section has determined that this year, the stunts presentations in competition for the Addison B. Day trophy will be conducted on a somewhat different basis than heretofore.

This popular Convention feature, last year attracted so much attention and participatión that it became difficult to handle the contest in one evening. This year the contests will be run under practically the same rules as heretofore except that there will be a series of regional eliminations prior to the Convention.

The Northern region includes Oregon, Washington and British Columbia. The Central region, northern California and Nevada. The Southern region, southern California and Arizona. All presentations will be sponsored by the Committee on Employees Relations with the Public, of which E. M. Seel, of the Pacific Gas and Electric Co. is chairman.

Al C. Joy, also of Pacific Gas and Electric Co., will be director of the stunts presentations, with George Mackenzie, of the Portland Gas & Coke Co. as director in the Northern region, and D. J. Bartelme, of the Pacific Gas and Electric Co., as director in the Central region, and L. H. Dell director in the Southern region.

Rules governing the contests have already been sent out to member companies and the regional eliminations will probably take place early in the summer. The winner in each region will receive a suitable trophy and will have an opportunity to compete for the Addison B. Day trophy at the San Francisco Convention.

The subject around which all plays and stunts must be written is "I am the Company."

Clyde H. Potter to Direct Speaking Contest

EARL M. SEEL, chairman of the Committee on Employees Relations with the Public, Public Relations Section, has announced that Clyde H. Potter of the Southern Counties Gas Co. will this year direct the Men's Public Speaking Contest, which has done so much in recent years to develop speakers among the employees of the Association's member companies. The topic of this contest is "Government Ownership of Public Utilities." The rules call for talks of not less than three nor more than five minutes.

The speaking this year will not take place at the luncheon, but before a general Association meeting.

The Women's Contest will be in charge of Miss Clarita Scott, Chairman of the Women's Committee. The topic is to be "The Place of Women in the Public Utility Industry."

The prize in each contest will be $50 for first prize and $25 for second prize. In addition to this, of course, each winner in the company contests is assured of a trip to the Convention.

HOURLY ORIFICE COEFFICIENTS FOR LIQUIDS

LINE (2½ AND 8 DIAM.) CONNECTIONS

ORIFICE DIA.	ACTUAL INTERNAL PIPE DIAMETER								
	15.25	13.25	12.09	10.19	8.071	6.065	4.026	3.068	2.067
	NOMINAL PIPE SIZE								
	16"	14"	12"	10"	8"	6"	4"	3"	2"
0.250	12.61	12.62	12.63	12.66	12.69	12.75	12.82	12.90	13.03
0.375	28.47	28.52	28.54	28.61	28.70	28.86	29.11	29.37	29.74
0.500	50.78	50.86	50.94	51.07	51.29	51.60	52.25	52.64	53.69
0.625	79.58	79.74	79.86	80.13	80.51	81.08	82.10	83.05	85.61
0.750	114.9	115.2	115.4	115.8	116.4	117.4	119.1	120.9	126.8
0.875	156.8	157.5	157.6	158.2	159.1	160.5	163.3	166.7	179.5
1.000	206.4	206.0	206.4	207.2	208.7	210.7	215.2	221.2	246.9
1.125	260.6	261.2	261.8	263.2	265.0	267.9	274.4	285.9	335.7
1.250	322.5	323.6	324.3	325.9	328.4	332.4	343.6	362.2	446.8
1.375	391.1	392.6	393.5	395.5	398.8	404.3	421.6	452.0	591.8
1.500	466.4	468.2	469.5	472.1	476.5	484.0	510.0	558.2	781.1
1.625	548.7	550.8	552.5	555.7	561.0	571.6	610.4	684.5	
1.750	637.6	640.3	642.2	646.2	653.5	667.6	724.5	854.0	
1.875	733.2	736.6	738.9	744.0	753.0	772.6	853.3	1012.	
2.000	835.1	839.9	842.8	848.9	860.6	886.9	1000.	1225.	
2.125	945.6	950.2	953.7	961.3	976.2	1011.	1168.	1480.	
2.250	1062.	1068.	1072.	1076.	1100.	1147.	1359.	1785.	
2.375	1186.	1192.	1197.	1208.	1238.	1294.	1577.		
2.500	1316.	1324.	1330.	1344.	1374.	1454.	1836.		
2.625	1454.	1463.	1470.	1487.	1525.	1627.	2111.		
2.750	1599.	1609.	1618.	1638.	1685.	1816.	2438.		
2.875	1751.	1763.	1775.	1798.	1857.	2022.	2810.		
3.000	1910.	1925.	1938.	1966.	2039.	2246.	3237.		
3.250	2251.	2271.	2287.	2331.	2440.	2757.			
3.500	2622.	2649.	2672.	2734.	2895.	3365.			
3.750	3024.	3060.	3092.	3180.	3410.	4091.			
4.000	3468.	3505.	3550.	3671.	3977.	4958.			
4.25	3984.	4039.	4046.	4215.	4654.	6001.			
4.50	4426.	4511.	4590.	4815.	5426.	7245.			
4.75	4963.	5075.	5179.	5480.	6328.				
5.00	5539.	5684.	5819.	6214.	7289.				
5.25	6154.	6341.	6516.	7028.	8426.				
5.50	6812.	7049.	7274.	7931.	9727.				
5.75	7515.	7815.	8099.	8929.	11212.				
6.00	8265.	8641.	9001.	10048.	12915.				
6.25	9068.	9529.	9980.	11288.					
6.50	9926.	10501.	11050.	12666.					
6.75	10844.	11546.	12219.	14196.					
7.00	11824.	12677.	13496.	15892.					
7.25	12874.	13906.	14894.	17796.					
7.50	13998.	15233.	16419.	19902.					
7.75	15200.	16676.	18089.						
8.00	16490.	18241.	19919.						
8.25	17872.	19950.	21917.						
8.50	19356.	21777.	24106.						
8.75	20945.	23777.	26474.						
9.00	22649.	25945.	29110.						
9.25	24483.	28300.							
9.50	26460.	30858.							
9.75	28556.	33646.							
10.00	30824.								
10.25	33250.								
10.50	35873.								
10.75	38674.								
11.00	41675.								
11.25	44882.								

W.L.C.
H.S.W.

ORIFICE METER HOURLY LIQUID COEFFICIENT
BASED ON
GALLONS OF WATER PER HOUR AT 60° F, SPECIFIC GRAVITY WATER AT 60°F=1.00

Hourly Liquid Coef. = $[340.0\ d^2 C_v]$
Where d = orifice diam. in inches
C_v = velocity coeff. (Gas values of C_v used for line taps.)

Coefficients do not correct for fluid over mercury in mercury type meters. This correction for mercury type meters is included in temperature factors for water and in the gravity factors for liquid hydrocarbons. Special temp. and gravity factors used in conjunction with above table of Hourly Coeff. are tabulated for both diaphragm type and mercury type meters. Unless specified = No seals are used.

Calculation of flow in gal. per hour at 60°F (Except in case of water when gal. at flow temperature are desired.)

$Q = [340.0\ d^2 C_v] \times T_f \times G_f \times \sqrt{h}$ Gals/hr. @ 60° where

T_f = Temperature factor. Tabulated per °F flowing tem. liq. in line
G_f = Gravity factors for liquid hydrocarbon tabulated for °API at 60°. No factor for water needed.
h = Differential over meter in inches of water.

Table No. 1.

HOURLY ORIFICE COEFFICIENTS FOR LIQUIDS

FLANGE CONNECTIONS

ORIFICE DIA.	ACTUAL INTERNAL PIPE DIAMETER								
	15.25	13.25	12.09	10.19	8.071	6.065	4.026	3.068	2.067
	NOMINAL PIPE SIZE								
	16"	14"	12"	10"	8"	6"	4"	3"	2"
0.250	12.72	12.72	12.72	12.72	12.72	12.72	12.72	12.72	12.73
0.375	28.62	28.62	28.62	28.62	28.62	28.62	28.62	28.60	28.69
0.500	50.87	50.87	50.87	50.88	50.88	50.90	50.94	50.98	51.12
0.625	79.49	79.50	79.49	79.50	79.53	79.55	79.65	79.75	80.16
0.750	114.5	114.5	114.5	114.5	114.5	114.6	114.8	115.0	116.2
0.875	155.8	155.8	155.8	155.9	156.0	156.1	156.4	156.9	159.8
1.000	203.6	203.6	203.6	203.7	203.8	203.9	204.3	205.1	212.1
1.125	257.6	257.7	257.7	257.8	258.0	258.3	259.2	261.5	274.8
1.250	318.1	318.2	318.2	318.4	318.6	319.0	320.9	325.0	360.6
1.375	385.0	385.0	385.1	385.3	385.6	386.5	389.5	396.8	445.5
1.500	458.2	458.3	458.4	458.7	459.4	460.1	465.4	478.0	509.0
1.625	537.9	538.0	538.1	538.5	539.9	540.7	548.9	569.6	
1.750	623.8	624.0	624.2	624.6	625.8	628.0	640.8	673.7	
1.875	716.4	716.6	716.8	717.3	718.3	722.0	741.5	792.1	
2.000	815.2	815.5	815.9	816.4	818.6	822.9	852.0	928.1	
2.125	920.4	920.9	921.2	922.1	924.5	931.2	973.2	1085.	
2.250	1032.	1033.	1033.	1034.	1037.	1047.	1107.	1268.	
2.375	1150.	1151.	1151.	1153.	1157.	1170.	1254.		
2.500	1275.	1275.	1276.	1278.	1284.	1301.	1418.		
2.625	1405.	1407.	1407.	1410.	1417.	1441.	1599.		
2.750	1543.	1544.	1545.	1549.	1558.	1590.	1802.		
2.875	1687.	1688.	1690.	1694.	1706.	1747.	2029.		
3.000	1837.	1839.	1841.	1846.	1861.	1916.	2284.		
3.250	2157.	2160.	2165.	2171.	2195.	2285.			
3.500	2503.	2508.	2512.	2524.	2562.	2704.			
3.750	2876.	2882.	2888.	2907.	2965.	3157.			
4.000	3275.	3284.	3292.	3319.	3407.	3735.			
4.25	3701.	3715.	3725.	3764.	3891.	4372.			
4.50	4154.	4171.	4184.	4244.	4425.	5121.			
4.75	4634.	4657.	4681.	4758.	5015.				
5.00	5143.	5174.	5207.	5315.	5665.				
5.25	5680.	5722.	5766.	5910.	6389.				
5.50	6246.	6302.	6361.	6554.	7197.				
5.75	6843.	6917.	6995.	7249.	8102.				
6.00	7469.	7566.	7687.	8000.	9119.				
6.25	8129.	8252.	8383.	8815.					
6.50	8822.	8980.	9146.	9701.					
6.75	9550.	9749.	9959.	10663.					
7.00	10314.	10554.	10809.	11715.					
7.25	11116.	11398.	11717.	12867.					
7.50	11961.	12343.	12754.	14151.					
7.75	12845.	13319.	13821.						
8.00	13776.	14353.	14969.						
8.25	14755.	15456.	16206.						
8.50	15785.	16635.	17542.						
8.75	16871.	17886.	18982.						
9.00	18017.	19231.	20539.						
9.25	19221.	20675.							
9.50	20501.	22219.							
9.75	21849.	23876.							
10.00	23276.								
10.25	24794.								
10.50	26401.								
10.75	28105.								
11.00	29921.								
11.25	31856.								

W.L.C.
H.S.W.

ORIFICE METER HOURLY LIQUID COEFFICIENT
BASED ON
GALLONS OF WATER PER HOUR AT 60°F, SPECIFIC GRAVITY WATER AT 60°F=1.00

Hourly Liquid Coef. = $[340.0\ d^2 C_v]$
Where d = orifice diam. in inches
C_v = velocity coeff. (Special liquid values C_v flg. taps.)

Coefficients do not correct for fluid over mercury in mercury type meters. This correction for mercury type meters is included in temperature factors for water and in the gravity factors for liquid hydrocarbons. Special temp. and gravity factors used in conjunction with above table of Hourly Coeff. are tabulated for both diaphragm type and mercury type meters. Unless specified = No seals are used.

Calculation of flow in gal. per hour at 60°F (Except in case of water when gal. at flow temperature are desired.)

$Q = [340.0\ d^2 C_v] \times T_f \times G_f \times \sqrt{h}$ Gals/hr. @ 60° where

T_f = Temperature factor. Tabulated per °F flowing tem. liq. in line.
G_f = Gravity factors for liquid hydrocarbon tabulated for °API at 60°. No factor for water needed.
h = Differential over meter in inches of water.

Table No. 2.

Measuring Non-Viscous Liquids by Orifice Meter

By WILLIAM L. COWAN
Union Oil Company of California

THIS paper, begun in *Western Gas* for April, 1931, and concluded in this issue, has for its purpose simplifying the calculation of flow of liquids through orifice meters, with due regard to the various types of gauges in use. Mr. Cowan is chairman of the Southern Califronia Meter Association Standards Committee, and his discussion was prepared in explanation of a number of data sheets published by the committee on measurement of non-viscous liquids. The concluding portion of the paper presents six tables giving hourly orifice coefficients and orifice meter temperature-gravity factors for water and light petroleum liquids, together with an explanation of their use.

Mr. Cowan's discussion was originally given before the February 26, 1931, meeting of the Southern California Meter Association.—*Editor.*

Tables No. 1 and No. 2—Hourly Liquid Coefficients:

Values shown on these tables equal ($340.0\ C_v d^2$), reference equations (14) and (15). They might be called the water coefficient for water at 60°F. which has a specific gravity of 1.000 and a temperature correction of 1.000, and where a diaphragm type gauge is used to record the differential pressure. In other words, where water is flowing at 60°F. and a diaphragm type of gauge is used, h^1 being equal to h,

$$(42)\quad Q = 340.0\ c_v d^2 \sqrt{h}$$

= Gals. per Hr. at 60°F.

$$(42)^1\quad Q = C\sqrt{h}$$

Due to the fact that the values of C are not definitely ascertained for orifice to line diameter ratios below perhaps 0.2 and above .6, it is advisable to stay between these limits of 0.2 and .6 when possible to do so. For ratios lower than 0.2 viscosity and other effects might enter in and above .6, pipe friction and orifice centering, etc. begin to cause irregularities. Fairly high differentials may be carried with free flowing liquids with but little error or change in the coefficient, C_v.

Table No. 3—Properties of and Volumetric Meter and Orifice Meter Factors for Water. $G_{60} = 1.000$

Column 1: Shows actual flowing temperature of water T°F.

Column 2: Shows pressure at which water will boil at temperatures corresponding to Column 1. For accurate water measurement it is essential that the static pressure of the water be held above this value for any corresponding value of T°F.

Column 3 = Weight of 1 cu. ft. of water in lbs. at any temp. T°F.

Column 4 = Volume occupied by 1 lb. water at T°F.

Column 5 = T_c = Temp. correction required to correct unit volume of liquid at T°F to an equivalent volume at 60°F.

Column 6: Diaphragm gauge orifice meter correction factor to be applied to (C) in formula (42)′ in order to find volume of water passing through the orifice at its *flowing temperature.* Referring to equation (14) it is seen that the final factor T_c is omitted in this case, leaving only $\sqrt{1/T_c}$ as shown in equation (13). As G_{60} is 1.000 for water, the only orifice meter factor required is that of $\sqrt{1/T_c}$ and flow in this instance =

$$(43) \quad Q_f = C\sqrt{\frac{1}{T_c}}\ \sqrt{h}$$

= Gals. per hr. at T°F.

Column 7: Diaphragm gauge orifice meter factor for water, in order to find volume of water corrected to 60°F. Referring to formula (15) the only correction to (C) in this case is $\sqrt{T_c/G_{60}}$. For water $G_{60} = 1.000$, so the only correction to (C) becomes $\sqrt{T_c}$ and the flow is calculated as follows:

$$(44) \quad Q_{60} = C\sqrt{T_c}\sqrt{h}$$

= Gals. per hr. at 60°F.

Column 8: Mercury gauge orifice meter factors are similar to diaphragm gauge corrections, except that the additional correction of

$$\sqrt{1-\frac{G_{60}}{13.58}}$$

must be applied, which is a constant for water equal to

$$\sqrt{1-\frac{1}{13.58}} = .96248$$

and flow becomes for volume at flowing temperature equal to

$$(45) \quad Q_f = C \times .96248\sqrt{\frac{1}{T_c}}\ \sqrt{h}$$

= Gals. per hr. at T°F.

Column 9: Mercury gauge orifice meter factors. The additional correction as applied in Column 8 must also be applied to equation (44) and flow corrected to 60°F. equals

$$(46) \quad Q_{60} = C \times .96248\sqrt{T_c}\sqrt{h}$$

Gals. per hr. at 60°F.

Note, in case of water measurement, errors often occur due to scale forming on inside of pipes, orifices, and sometimes even in the gauges. Air is also generally carried along in the water and when pressures change this air is sometimes allowed to free itself and collect in gauge lines, possibly causing considerable error. Correct gauge piping, remedies this latter error.

Columns No. 1, 2, 3, 4, have been taken from Goodenough's Steam Tables.

Temperatures up to 400°F. have been given, covering practically all possible conditions occurring in practical operation.

Tables No. 4 and No. 5—Orifice Meter Specific Gravity Correction Factors for Liquids.

These tables include specific gravity corrections which when used for petroleum groups shown must be used in conjunction with the temperature correction factors shown on Table No. 6. Corrections have been made per ½° A.P.I. The orifice meter S.G. factors shown can be used for other non-viscous liquids having corresponding specific gravities, if the correction for temperature is figured for the liquid in question.

In case of diaphragm type gauges, where the same liquid as that flowing in the line is used in the gauge, or where sealing fluids are used, the correction is $G_f = \sqrt{1/G_{60}}$ as seen from equation (15). The sealing liquid levels in each pot are assumed to remain equal and constant.

For mercury type gauges, no seal (that is, when the same liquid as that flowing in the line is over the mercury in the gauge) the correction factor F, from equation (30) has been combined to the flow correction $\sqrt{1/G_{60}}$, making a combined factor.

$$(47) \quad G_f = \sqrt{\frac{1}{G_{60}}\left(1-\frac{G_{60}}{13.58}\right)}$$

For mercury type gauges—using water and the sealing fluid and pots of such size that no appreciable change occurs between sealing liquid and flowing liquid, the correction for fluid over the mercury is equal to F, as shown in equation (33), making the combined factor,

$$(48) \quad G_f = \sqrt{\frac{1}{G_{60}}\left(1-\frac{1}{13.58}\right)}$$

For reference the conversion of °A.P.I. at 60°F. to S.G. and 60°F. (Water at 60°F. = 1.000) for liquids lighter than water, might be given as follows,

$$(49) \quad \text{S.G.} = \frac{141.5}{131.5 + °\text{A.P.I @ } 60°\text{F.}}$$

In determining the specific gravities, especially of the very high vapor pressure hydrocarbon liquids, it is advisable to take gravity samples under a pressure equal to that at which they are flowing in the line, for many of the lighter fractions would vaporize off if exposed to atmospheric pressure and thus cause a heavier gravity to be recorded than that actually flowing through the line.

Table 6: Gasoline Orifice Meter Temperature correction factors have been derived from the volumetric corrections given on S.C.M.A. Data Sheet No. 141. They have not been shown for gasoline or distillate gravities lower than 51° A.P.I. at 60°F. Other factors can be worked out for these lower gravities at some future date. The volumetric corrections given on Data Sheet No. 141 were taken from the "Abridged Bureau of Standards", Bulletin 154, National Petroleum Oil Tables. These factors have been taken from the average temperature variations of the gasolines having S.G. within the limits specified by group.

Following are the approximate coefficients of expansions (C_e) used for the various groups shown:

Group I—Up to 34.9° A.P.I. at 60° =.0004

Group II—35.0 to 50.9 A.P.I. at 60°=.0005

Group III—51.0 to 63.9 A.P.I. at 60°=.0006

Group IV—64.0 to 78.9 A.P.I. at 60°=.0007

Group V—79.0 to 88.9 A.P.I. at 60°=.0008

Group VI*—88.9 and higher ° A.P.I. at 60°=.00085.

**Note:* This latter group shown as 88.9 and higher is not exactly correct, for the value of .00085 only holds up to perhaps 95° A.P.I. at 60°F., and therefore coefficients figured from U. S. Bureau of Standards Miscellaneous Publication No. 97 should be used for the lighter liquids having indicated °A.P.I. above 96.0.

In actual practice, gasolines at higher temperatures than those shown are often measured at high pressures where the liquid is a true liquid. In such instances the corrections for temperature for orifice meters (T_f) can be calculated as follows—Reference

April 23 Program of S. C. M. A.

TWO interesting papers made up the Southern California Meter Association's April 23 program, which was run off in the Auditorium of the Los Angeles Gas & Electric Corp. following dinner in the corporation's banquet hall.

H. M. Dwight of the Southern California Gas Co. presented a discussion of "Accuracy Expectancy in Orifice Meter Measurement," dealing with metering data resulting under practical measurement conditions.

"Fundamentals Underlying the Design and Operation of Pressure Regulators," by L. H. Brendel of Neilan Co., Inc., was the concluding paper of the evening, illustrated by slides. Discussion participated in by many present added to the value of both papers.

C. A. Wheeler of the Robinson Orifice Fitting Co. was winner of the Association's monthly golf tournament of March 22, and was presented with the S. C. M. A.-*Western Gas* Golf Trophy at the April meeting by A. E. DeBurn, chairman of the golf committee.

Gas Line Movies for May Meeting

SOMETHING unusual is in store for Southern California Meter Association members at the May 28 meeting, arranged to be held at the Los Angeles Gas & Electric Corp. building. Two papers dealing with phases of the Southern California Gas Co.'s Kettleman Hills-Los Angeles 22-26-inch transmission line are on the program, to be illustrated with a motion picture of construction operations on this carrier.

B. M. Laulhere will describe construction problems, treating especially of line laying methods through mountainous portions of the route. The motion picture will supplement Mr. Laulhere's description.

B. G. Williams, measurement engineer for the Southern California Gas Co., and this year's president of the S. C. M. A., will deliver a paper on the design of large volume measurement stations, featuring the three stations on the above line.

The May meeting is the last before annual elections, and a good turnout is anticipated.

PROPERTIES OF, AND VOLUMETRIC METER AND ORIFICE METER FACTORS FOR WATER

Flowing Temperature °F	Saturation Pressure Lbs./Sq. In. Abs.	Weight W = Lbs./Cu. Ft.	Specific Volume V = Cu. Ft./Lb.	Volumetric Temperature Correction $T_c = V_{60}/V_t$ Corrects Vol @ t° F to Vol. @ 60° F	* ORIFICE METER FACTORS — DIAPHRAGM TYPE GAUGES: Factor = $\sqrt{T_c}$ Gals at Flowing Temperature	DIAPHRAGM TYPE GAUGES: Factor = $\sqrt{T_c}$ Gals at 60° F	MERCURY TYPE GAUGES: Factor = $.96248\sqrt{T_c}$ Gals at Flowing Temperature	MERCURY TYPE GAUGES: Factor = $96248\sqrt{T_c}$ Gals at 60° F
40	0.122	62.43	.01602	1.0006	.9997	1.0003	.9622	.9628
50	0.178	62.42	.01602	1.0006	.9997	1.0003	.9622	.9628
60	0.256	62.37	.01603	1.0000	1.0000	1.0000	.9625	.9626
70	0.363	62.30	.01605	.9988	1.0006	.9994	.9631	.9619
80	0.507	62.22	.01607	.9975	1.0012	.9987	.9636	.9612
90	0.698	62.11	.01610	.9967	1.0022	.9978	.9646	.9604
100	0.949	62.00	.01613	.9938	1.0031	.9969	.9655	.9595
110	1.274	61.86	.01616	.9920	1.0040	.9960	.9663	.9586
120	1.692	61.71	.01620	.9895	1.0053	.9947	.9676	.9574
130	2.221	61.56	.01625	.9868	1.0068	.9932	.9690	.9559
140	2.887	61.38	.01629	.9840	1.0081	.9920	.9703	.9548
150	3.716	61.20	.01634	.9810	1.0096	.9905	.9717	.9533
160	4.739	61.00	.01639	.9780	1.0112	.9889	.9733	.9518
170	5.99	60.80	.01645	.9745	1.0130	.9872	.9750	.9502
180	7.51	60.58	.01651	.9709	1.0149	.9853	.9768	.9483
190	9.34	60.36	.01657	.9674	1.0167	.9836	.9785	.9467
200	11.53	60.12	.01663	.9639	1.0186	.9818	.9804	.9450
210	14.12	59.88	.01670	.9599	1.0207	.9797	.9824	.9429
220	17.19	59.63	.01677	.9559	1.0228	.9777	.9844	.9410
230	20.78	59.37	.01684	.9519	1.0249	.9757	.9864	.9391
240	24.97	59.11	.01692	.9474	1.0274	.9733	.9889	.9368
250	29.83	58.83	.01700	.9429	1.0299	.9710	.9913	.9346
260	35.44	58.55	.01708	.9385	1.0322	.9688	.9935	.9325
270	41.87	58.26	.01716	.9341	1.0347	.9665	.9959	.9302
280	49.22	57.96	.01725	.9293	1.0373	.9640	.9984	.9278
290	57.57	57.65	.01735	.9239	1.0404	.9612	1.0014	.9251
300	67.02	57.32	.01745	.9186	1.0434	.9584	1.0043	.9224
310	77.68	56.98	.01755	.9134	1.0463	.9557	1.0070	.9198
320	89.65	56.62	.01766	.9077	1.0496	.9527	1.0102	.9170
330	103.0	56.24	.01778	.9016	1.0532	.9495	1.0137	.9139
340	118.0	55.85	.01790	.8965	1.0567	.9463	1.0171	.9108
350	134.6	55.48	.01803	.8891	1.0606	.9429	1.0207	.9075
360	153.0	55.06	.01816	.8827	1.0644	.9395	1.0245	.9042
370	173.2	54.66	.01829	.8764	1.0682	.9362	1.0281	.9011
380	196.6	54.25	.01843	.8698	1.0722	.9326	1.0320	.8976
390	220.1	53.84	.01857	.8632	1.0763	.9291	1.0359	.8942
400	247.	53.42	.0187	.8572	1.0801	.9259	1.0396	.8912

* Orifice Meter Factors To Be Used In Conjunction with Following Formulae

(1) Ordinary Differential Charts

$Q\ (Gals/Hour) = [340.0\ c_v d^2] \times Factor \times \sqrt{h}$

(2) Square Root Charts

$Q\ (Gals/Hour) = [340.0\ c_v d^2] \times Factor \times [R \times M]$

Where $[340.0\ c_v d^2]$ = Hourly Liquid Coefficient

c_v = Velocity Coef. of orifice
d = Diam. orifice in inches

Factor (obtained from above table)

h = Recorded Differential over Orifice in In. Water @ 60°F.

M = Square Root Chart Factor = $\sqrt{.01} \times$ Diff. Range Gauge

R = Square Root Chart Reading

Note:
Spec. Gravity of Water at 60° = 1.000

Spec. Grav. factor for Diaphram type gauges $= \sqrt{\frac{1}{G_{60}}} = \sqrt{\frac{1}{1.00}} = 1.000$

Spec. Grav. factor for mercury type gauges $= \sqrt{\frac{1}{G_{60}}\left(1 - \frac{G_{60}}{13.56}\right)}\sqrt{\frac{1}{1.00}\left(1 - \frac{1.000}{13.56}\right)}$

$= .96248$ = (A constant)

These Gravity factors have been included in temperature factors as shown above

Table No. 3.

ORIFICE METER SPECIFIC GRAVITY CORRECTION FACTORS FOR LIQUIDS

Sheet 1

Group	°A.P.I. @ 60°F	Specific Gravity @ 60°F = G_{60} Based on Water @ 60°F = 1.000	ORIFICE METER FACTORS: DIAPHRAGM TYPE GAUGES Factor = $\sqrt{\frac{1}{G_{60}}}$	MERCURY TYPE GAUGES: NO SEAL Factor = $\sqrt{\frac{G_{60}}{13.56}}\sqrt{\frac{1}{13.56}}$	MERCURY TYPE GAUGES: WATER SEAL LARGE AREA Factor = $\sqrt{\frac{1}{13.56}}\sqrt{\frac{1}{13.56}}$
Group I Petroleum	30.0	.8762	1.0683	1.0333	1.0282
	30.5	.8735	1.0700	1.0350	1.0298
	31.0	.8708	1.0716	1.0367	1.0314
	31.5	.8681	1.0733	1.0384	1.0330
	32.0	.8654	1.0750	1.0401	1.0346
	32.5	.8628	1.0766	1.0418	1.0362
	33.0	.8602	1.0782	1.0435	1.0377
	33.5	.8576	1.0798	1.0452	1.0393
	34.0	.8550	1.0815	1.0469	1.0409
	34.5	.8524	1.0831	1.0486	1.0425
Group II Petroleum	35.0	.8498	1.0848	1.0503	1.0441
	35.5	.8473	1.0864	1.0520	1.0456
	36.0	.8448	1.0880	1.0536	1.0472
	36.5	.8423	1.0896	1.0553	1.0487
	37.0	.8398	1.0912	1.0569	1.0503
	37.5	.8373	1.0928	1.0586	1.0518
	38.0	.8348	1.0944	1.0603	1.0533
	38.5	.8324	1.0960	1.0619	1.0549
	39.0	.8299	1.0977	1.0636	1.0565
	39.5	.8275	1.0993	1.0653	1.0580
	40.0	.8251	1.1009	1.0669	1.0596
	40.5	.8227	1.1025	1.0686	1.0611
	41.0	.8203	1.1041	1.0702	1.0627
	41.5	.8179	1.1057	1.0719	1.0642
	42.0	.8155	1.1073	1.0736	1.0658
	42.5	.8132	1.1089	1.0752	1.0673
	43.0	.8109	1.1105	1.0768	1.0688
	43.5	.8086	1.1121	1.0785	1.0704
	44.0	.8063	1.1137	1.0801	1.0719
	44.5	.8040	1.1152	1.0817	1.0734
	45.0	.8017	1.1168	1.0834	1.0749
	45.5	.7994	1.1185	1.0850	1.0765
	46.0	.7972	1.1200	1.0866	1.0780
	46.5	.7949	1.1216	1.0883	1.0795
	47.0	.7927	1.1232	1.0899	1.0810
	47.5	.7905	1.1247	1.0915	1.0825
	48.0	.7883	1.1263	1.0931	1.0840
	48.5	.7861	1.1279	1.0947	1.0856
	49.0	.7839	1.1295	1.0964	1.0871
	49.5	.7818	1.1310	1.0979	1.0885
	50.0	.7796	1.1326	1.0996	1.0901
	50.5	.7775	1.1341	1.1012	1.0915
Group III Petroleum	51.0	.7753	1.1357	1.1028	1.0931
	51.5	.7732	1.1372	1.1044	1.0946
	52.0	.7711	1.1388	1.1060	1.0961
	52.5	.7690	1.1404	1.1076	1.0976
	53.0	.7669	1.1419	1.1092	1.0991
	53.5	.7649	1.1434	1.1107	1.1005
	54.0	.7628	1.1450	1.1124	1.1020
Group III Petroleum	54.5	.7608	1.1465	1.1139	1.1035
	55.0	.7587	1.1481	1.1155	1.1050
	55.5	.7567	1.1496	1.1171	1.1064
	56.0	.7547	1.1511	1.1187	1.1079
	56.5	.7527	1.1526	1.1202	1.1094
	57.0	.7507	1.1542	1.1218	1.1108
	57.5	.7487	1.1557	1.1234	1.1123
	58.0	.7467	1.1572	1.1250	1.1138
	58.5	.7447	1.1588	1.1266	1.1153
	59.0	.7428	1.1603	1.1281	1.1167
	59.5	.7408	1.1618	1.1297	1.1182
Group IV	60.0	.7389	1.1633	1.1312	1.1197
	60.5	.7370	1.1648	1.1328	1.1211
	61.0	.7351	1.1663	1.1343	1.1226
	61.5	.7332	1.1679	1.1359	1.1240
	62.0	.7313	1.1694	1.1374	1.1255
	62.5	.7294	1.1709	1.1390	1.1270
	63.0	.7275	1.1724	1.1406	1.1284
	63.5	.7256	1.1740	1.1422	1.1299
Group IV	64.0	.7238	1.1754	1.1437	1.1313
	64.5	.7219	1.1770	1.1452	1.1328
	65.0	.7201	1.1784	1.1467	1.1342
	65.5	.7183	1.1799	1.1483	1.1356
	66.0	.7165	1.1814	1.1497	1.1371
	66.5	.7146	1.1830	1.1514	1.1386
	67.0	.7128	1.1844	1.1529	1.1400
	67.5	.7111	1.1859	1.1544	1.1414
	68.0	.7093	1.1873	1.1560	1.1428
	68.5	.7075	1.1889	1.1575	1.1443
	69.0	.7057	1.1904	1.1591	1.1457
	69.5	.7040	1.1918	1.1605	1.1471
	70.0	.7022	1.1934	1.1621	1.1486
	70.5	.7005	1.1948	1.1636	1.1500
	71.0	.6988	1.1962	1.1650	1.1514
	71.5	.6970	1.1978	1.1666	1.1528
	72.0	.6953	1.1992	1.1681	1.1542
	72.5	.6936	1.2007	1.1697	1.1557
	73.0	.6919	1.2022	1.1712	1.1571
	73.5	.6902	1.2037	1.1727	1.1585
	74.0	.6886	1.2051	1.1741	1.1599
	74.5	.6869	1.2066	1.1757	1.1613
	75.0	.6852	1.2081	1.1772	1.1627
	75.5	.6836	1.2095	1.1786	1.1641
	76.0	.6819	1.2110	1.1802	1.1655
	76.5	.6803	1.2124	1.1816	1.1669
	77.0	.6787	1.2138	1.1831	1.1683
	77.5	.6770	1.2154	1.1847	1.1698
	78.0	.6754	1.2168	1.1861	1.1711
	78.5	.6738	1.2182	1.1876	1.1725

Table No. 4.

Formula (15)— where t = flowing temperature °F.

$$(50)\quad T_f = \sqrt{T_c} = \sqrt{\frac{1}{1 + (t - 60)\,C_e}}$$

Knowing then both the orifice meter gravity factor G_f and the orifice meter temperature factor T_f, the actual flow can now be computed as follows:

$$Q = (340\,0\,c_v d^2)\ G_f T_f \sqrt{h}$$

Gals. per hr. at 60°F. or

$$Q = C G_f T_f \sqrt{h}$$

Gals. per hr. at 60°F.

Where square root charts are used and the orifice meter square root chart factor = M and the chart reading equals R,

$$Q = C G_f T_f M R$$

Gals. per hr. at 60°F.

Further discussion on pot sizes needed, standard gauge hook-ups, etc., will not be given at this time, other than to note the following:

(a) Slopes of gauge lines should always be over 1 inch per foot.

(b) Arrange piping to eliminate possibilities of gas pockets, or foreign fluid or dirt, collecting in gauge or gauge lines at vital points.

(c) Keep liquid in line above its vapor pressure at all times.

(d) Do not use seals unless absolutely essential for these gasolines or distillates shown.

(e) A by-pass should be installed as near the orifice as possible.

(f) Pulsation does not cause such serious errors in liquid measurement as in gas measurement, except when a large change of flow or vibration of meter run and gauge occurs. Use gaskets, lubricants, etc., in gauges that are not affected by oil or gasolines when measuring these fluids.

Southwestern Measurement Men in Annual Meeting

WITH an attendance of well over 350, representing two score of states, the Annual Southwestern Gas Measurement Short Course convened on April 21, 22, and 23, at the University of Oklahoma, Norman. The course is conducted each year by the College of Engineering of the University, assisted by the Natural Gas Department of the American Gas Association, the Natural Gasoline Association, the Oklahoma Utilities Association and equipment manufacturers, and deals particularly with natural gas measurement problems.

J. H. Felgar, dean of the College of Engineering, presided at the opening session, and gave the address of welcome. Dean Felgar was introduced by E. F. McKay, director of the Oklahoma Utilities Association.

The course is divided into classes and assembly sessions, the classes being given over to specialized subjects, while general subjects are discussed in the larger gatherings.

E. J. Stephany, secretary of the Natural Gas Department, A. G. A., represented that organization on the program with a paper on the history and development of the natural gas industry, delivered at the morning general session on April 21.

New Officers and Board for Cutler-Hammer, Inc.

At the annual meeting of Cutler-Hammer, Inc., manufacturer of control apparatus, Milwaukee, Wis., held April 14, Frank R. Bacon, former chairman of the board, was elected president to fill the vacancy caused by the death of Beverly L. Worden. The office of chairman of the board was abolished.

OREGON
IDAHO
MONTANA
WYOMING
PORTLAND
VANCOUVER
FOREST GROVE
GRESHAM
OREGON CITY
Portland Gas & Coke Co. (Manufactured Gas)
DALLAS
MT. ANGEL
SALEM
CORVALLIS
ALBANY
TOPPENISH
MABTON
Benton County Field
Natural
PROSSER
PASCO
ATTALIA
KENNEWICK
WALLA WALLA
BAKER CITY
Mountain States
WEISER
PAYETTE
Oil and Gas Co.
BOISE
POCATELLO
Public Service Co.
FRANKLIN
PRESTON
LOGAN
Public Service
DEER LODGE
ANACONDA
HELENA
BUTTE
GREAT FALLS
Northwest States Utilities Co.
LEWISTOWN
Lewistown Natural Gas Co.
GLASGOW
GLENDIVE
TERRY
Montana-Dakota
MILES CITY
ISMAY
BOZEMAN
LIVINGSTON
Billings Gas Co.
COLUMBUS
Lake Basin Field
BILLINGS
HARDIN
Big Horn Gas Co.
Dry Creek Field
RED LODGE
Elk Basin Field
Rocky Mountain Gas Co.
LOVELL
Lovell Gas Co.
POWELL
CODY
Rocky Mountain Gas Co.
N. Oregon Basin
Big Horn Gas Co.
Little Buffalo Basin
Thermopolis Gas Co.
THERMOPOLIS
GREYBULL BASIN
Mid-West Wyoming Gas Co.
WORLAND
Hidden Dome
SHERIDAN
Northwest States Utilities Co.
BUFFALO
Dry Creek Field
WASHAKIE
RIVERTON
LANDER
Sand Draw Field
New York Oil Co.
North Central Gas
POWDER RIVER
POISON SPIDER
CASPER
MIDWEST
GLENROCK
DOUGLAS
WERTZ
Rocky Mountain Gas Co.
Mahoney Dome
GUERNSEY
Osage Field

EDMONTON
12"
Northwestern Utilities, Ltd.
TOFIELD
RYLEY
HOLDEN
BRUCE
VIKING
Viking Field
Wainwright Field
C A N
CALGARY
10"
Canadian Western Natural Gas, Light, Heat & Power Co. Ltd.
OKOTOKS
16"
HIGH RIVER
CAYLEY
NANTON
Turner Valley Field
PARKLAND
STAVELY
CLARESHOLM
GRANUM
MC CLEOD
LETHBRIDGE
CHIN
BURDETT
Bow Island Field
Many Islands Field
Medicine Hat Field
Barnwell Field
Canadian Western Natural Gas, Light, Heat & Power Co. Ltd.
Foremost Field
Red Coulee Field
Rogers Imperial Field
Kevin-Sunburst Field
Sweetgrass Hills Field
Northwest States Utilities Co.
Cut Bank Field
CUT BANK
VALIER
SHELBY
BYNUM
CONRAD
CHOTEAU
HAVRE
CHINOOK
Montana Gas Corp.
Bowes Field
Bowdoin-Saco Field
Bowdoin
MALTA
SACO
SEATTLE
Seattle Gas Co. (Mfg. Gas)
TACOMA
KENT
PUYALLUP
OLYMPIA
Washington Gas & Electric Co. (Mfg. Gas)
Drumheller Interests
SPOKANE
COEUR D'ALENE
KALISPELL
GLACIER PARK
Drumheller Interests
WASHINGTON
YAKIMA
Northwestern Benton Co.
WAPATO
TOPPENISH

CALIFORNIA
ARIZONA
NEW MEXICO
COLORADO
WATSONVILLE
SAN JUAN
PACIFIC GROVE
MONTEREY
CARMEL
SALINAS
Coast Counties Gas & Electric Co.
TRES PINOS
LOS BANOS
DOS PALOS
LLANADA
Pacific Gas and Electric Co.
MADERA
FRESNO
SANGER
REEDLEY
DINUBA
KINGSBURG
VISALIA
EXETER
LINDSAY
STRATHMORE
PORTERVILLE
Kettleman Hills Field
HANFORD
TULARE
CORCORAN
DELANO
Southern Calif Gas Co.
WASCO
SHAFTER
OIL CENTER
BAKERSFIELD
San Joaquin Light & Power Corp.
Elk Hills Field
TAFT
MONOLITH
TEHACHAPI
So. Calif Gas Co.
Southern California Gas Co.
Bueno Vista Hills Field
MARICOPA
BICKNELL
Santa Maria Gas Co
SANTA MARIA
NIPOMO
McKITTRICK
ARROYO GRANDE
EDNA
SAN LUIS OBISPO
Southern Fuel Co.
ATASCADERO
PASO ROBLES
SANTA MARGARITA
PORT SAN LUIS
GUADALUPE
BETTERAVIA
LOMPOC
GAVIOTA
GOLETA
So. Counties
OJAI
FILLMORE
SANTA BARBARA
CARPINTERIA
VENTURA
SANTA PAULA
Ventura Fuel Co.
NEWHALL
SAN FERNANDO
SUNLAND
GLENDALE
PASADENA
VENICE
LOS ANGELES
REDONDO
SAN PEDRO
LONG BEACH
HUNTINGTON BEACH
POMONA
PUPLAND
SAN BERNARDINO
COLTON
REDLANDS
RIVERSIDE
BEAUMONT
So. Calif Gas Co.
ANAHEIM
CORONA
SANTA ANA
PERRIS
ELSINORE
HEMET
PALM SPRINGS
LAGUNA BEACH
SAN JUAN CAPISTRANO
SAN CLEMENTE
OCEANSIDE
LA JOLLA
PACIFIC BEACH
OCEAN BEACH
CORONADO
SAN DIEGO
San Diego Consolidated Gas and Electric Co. (Manufactured Gas)
EL CAJON
SPRING VALLEY
NATIONAL CITY
CHULA VISTA
SAN YSIDRO
Los Angeles Basin lines are those of Pacific Lighting Corp. subsidiaries, including Industrial Fuel Supply Co., Los Angeles Gas and Electric Corp., Southern California Gas Co., Southern Counties Gas Co., and Ventura Fuel Co. Southern Fuel Co. line to Long Beach is also shown.
Colorado Natural
FOUNTAIN
CANON CITY
PORTLAND
PUEBLO
COLORADO
THATCHER
DURANGO
Southern Union Gas Co
Ute Baker Field
FARMINGTON
Kutz Canyon Field
Southern Union Gas Co.
SANTA FE
Southern Union
LAS VEGAS
ALBUQUERQUE
BERNALILLO
LOS LUNAS
BELEN
TUCUMCA
ROSWELL
Pecos Valley Gas Co.
Artesia Field

BOISE
POCATELLO
Pacific Power & Light Co.
FRANKLIN
PRESTON
LOGAN
BRIGHAM
OGDEN
Mountain Fuel Supply Co.
GARFIELD
TOOELE
Wasatch Gas Co.
SALT LAKE CITY
SANDY
PROVO
COALVILLE
EVANSTON
Uinta Pipe Line Co.
LYMAN
RUSH SPRINGS
North Baxter Basin
S. Baxter Basin
Clay Basin Field
Hiawatha Dome
CODY
Rocky Mountain Gas Co.
N. Oregon Basin
Little Buffalo Basin
Big Horn Gas Co.
GREYBULL BASIN
Mid-West Wyoming Gas Co.
Hidden Dome
MANDERSON
WORLAND
Thermopolis Gas Co.
THERMOPOLIS
BUFFALO
Billy Creek Field
Osage Field
WASHAKIE
RIVERTON
LANDER
Sand Draw Field
New York Oil Co.
North Central Gas Co.
POWDER RIVER
Mid-West Wyoming Gas Co.
MIDWEST
CASPER
POISON SPIDER
Rocky Mountain Gas Co.
GLENROCK
DOUGLAS
Lance Creek Field
WERTZ
Mahoney Dome
RAWLINS
GUERNSEY
North Central Gas Co.
WHEATLAND
TORRINGTON
LARAMIE
FT. WARREN
CHEYENNE
FT. COLLINS
LOVELAND
BERTHOOD
GREELEY
LA SALLE
JOHNSTOWN
BOULDER
FT. LUPTON
BRIGHTON
GOLDEN
DENVER
FITZSIMONS
AURORA
LITTLETON
CHICO
WILLOWS
OROVILLE
(Manufactured Gas)
MARYSVILLE
Pacific Gas and Electric Co
NEVADA CITY
GRASS VALLEY
WHEATLAND (Mfg. Gas)
WILLIAMS
ARBUCKLE
LINCOLN
ROSEVILLE
SACRAMENTO
HEALDSBURG
SANTA ROSA
CALISTOGA
SEBASTOPOL
Pacific Gas and Electric
PETALUMA
WOODLAND
NAPA
DAVIS
RICHMOND
MARTINEZ
DIXON
PITTSBURG
SAN RAFAEL
OAKLAND
SAN FRANCISCO
BYRON
DANVILLE
LODI
HAYWARD
SAN LEANDRO
CENTERVILLE
STOCKTON
OAKDALE
RIVER BANK
SALIDA
MODESTO
SAN MATEO
REDWOOD CITY
IRVINGTON
MILPITAS
SAN JOSE
LOS GATOS
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GILROY
NEWMAN
GUSTINE
MERCED
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Pacific Gas and Electric Co
NEVADA
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COLORADO
WYOMING

Gas Transmission Lines

Published in the May, 1931, Natural Gas Edition of

WESTERN GAS

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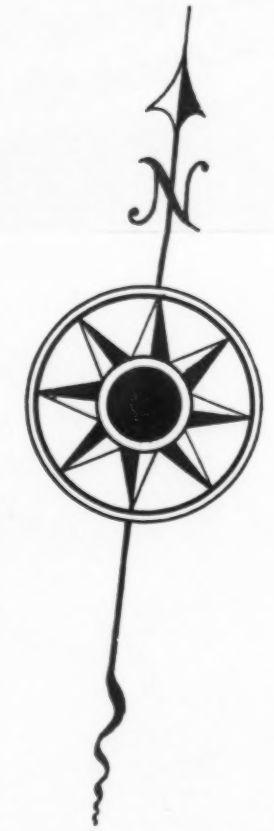
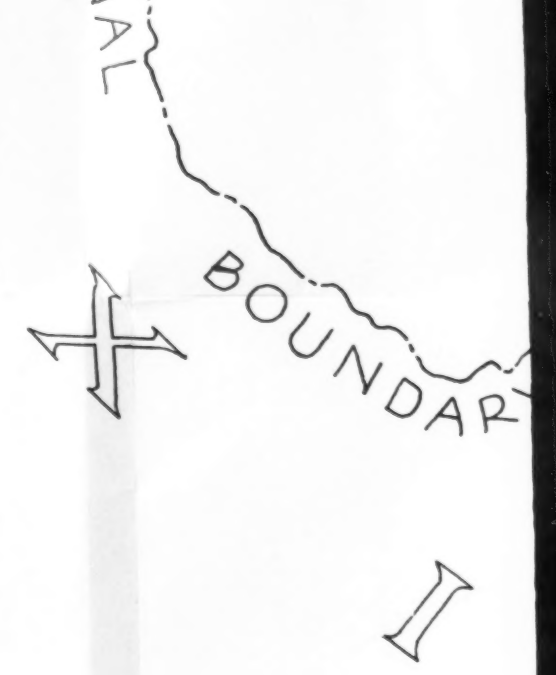


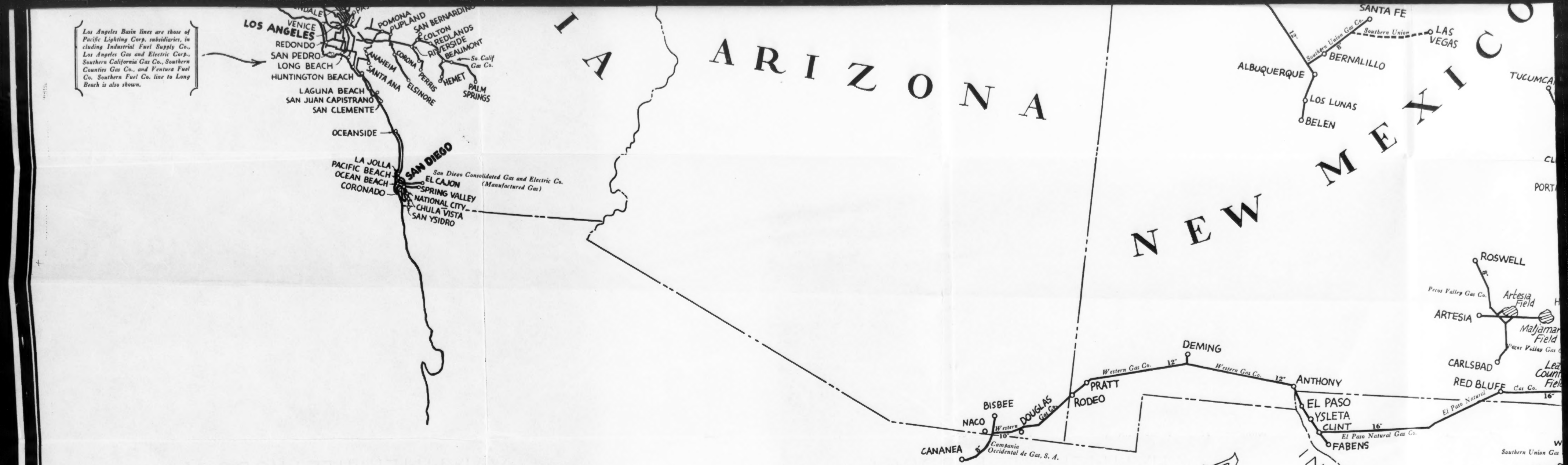


LEGEND

Transmission Lines (Including Lines Under Construction).

Projected Gas Transmission Lines

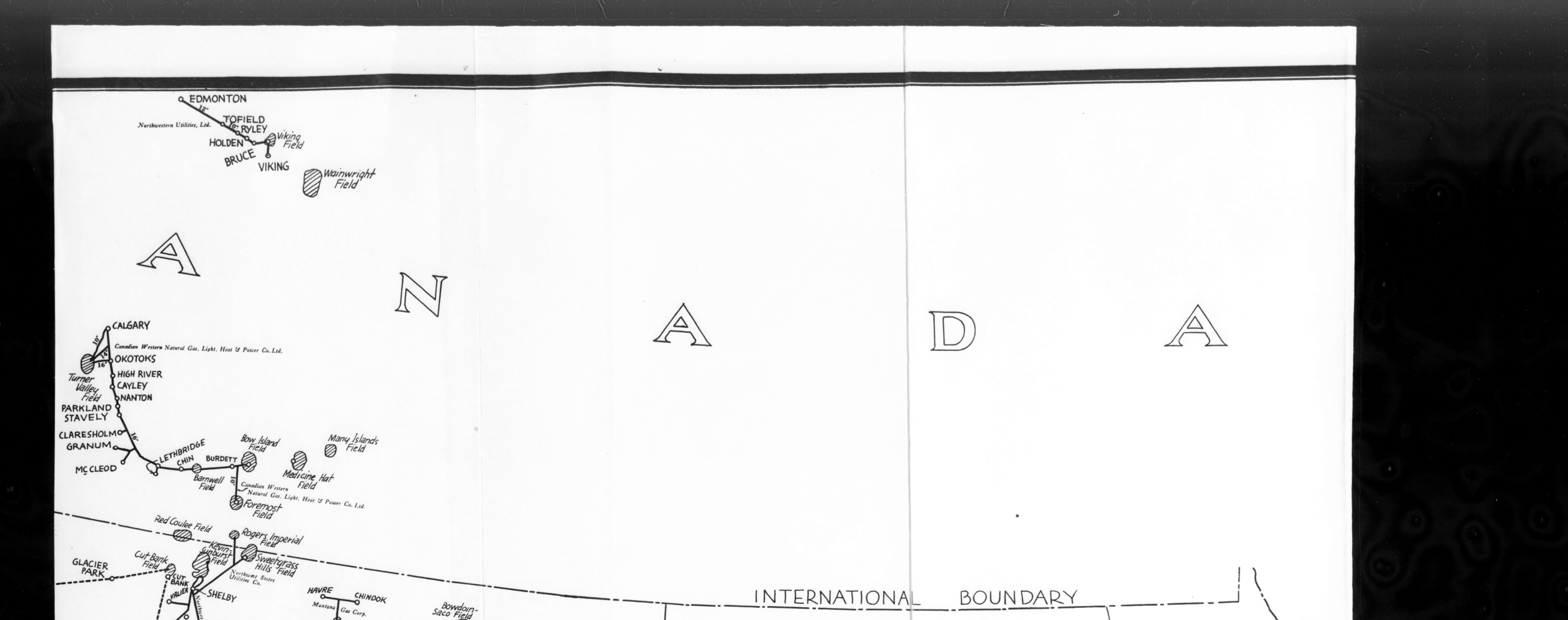
Gas Source

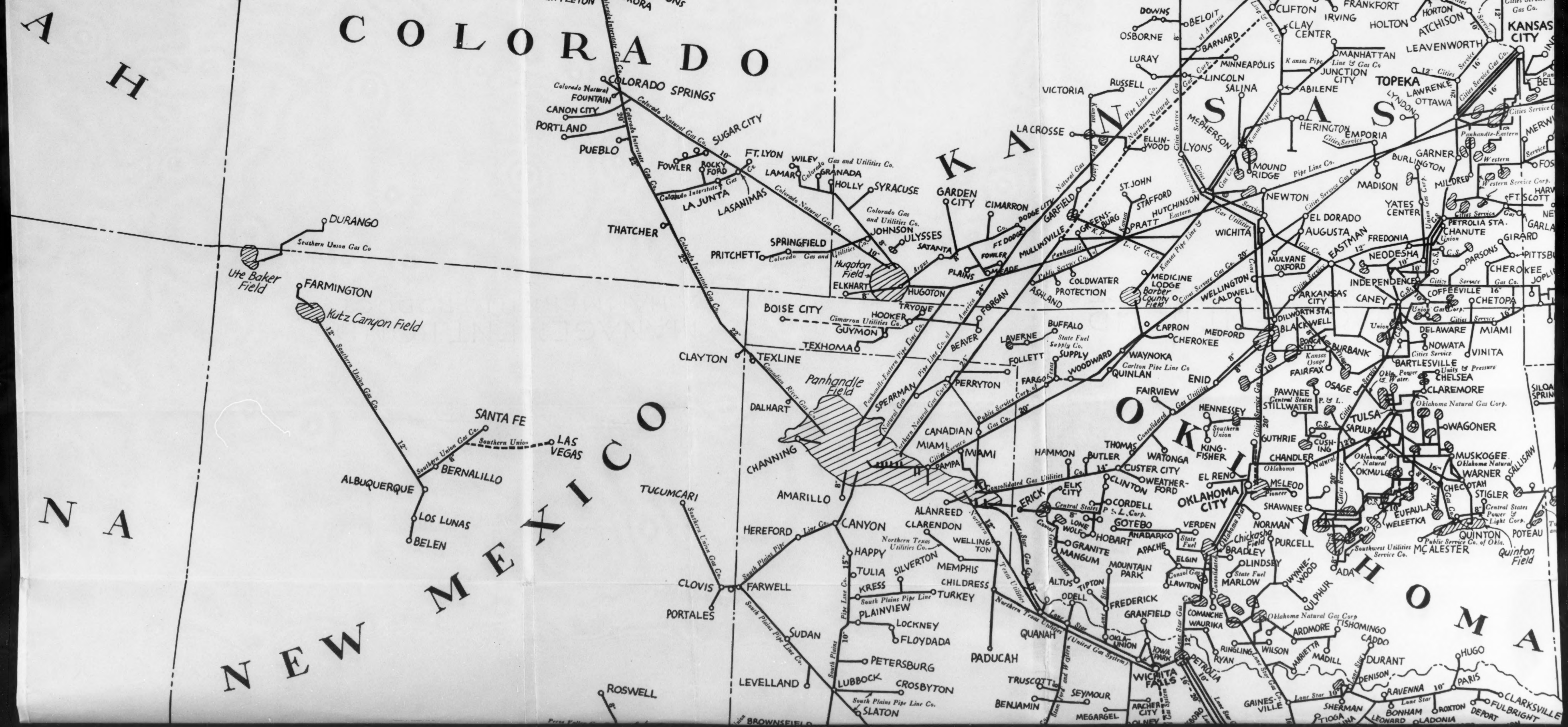


WESTERN AMERICA

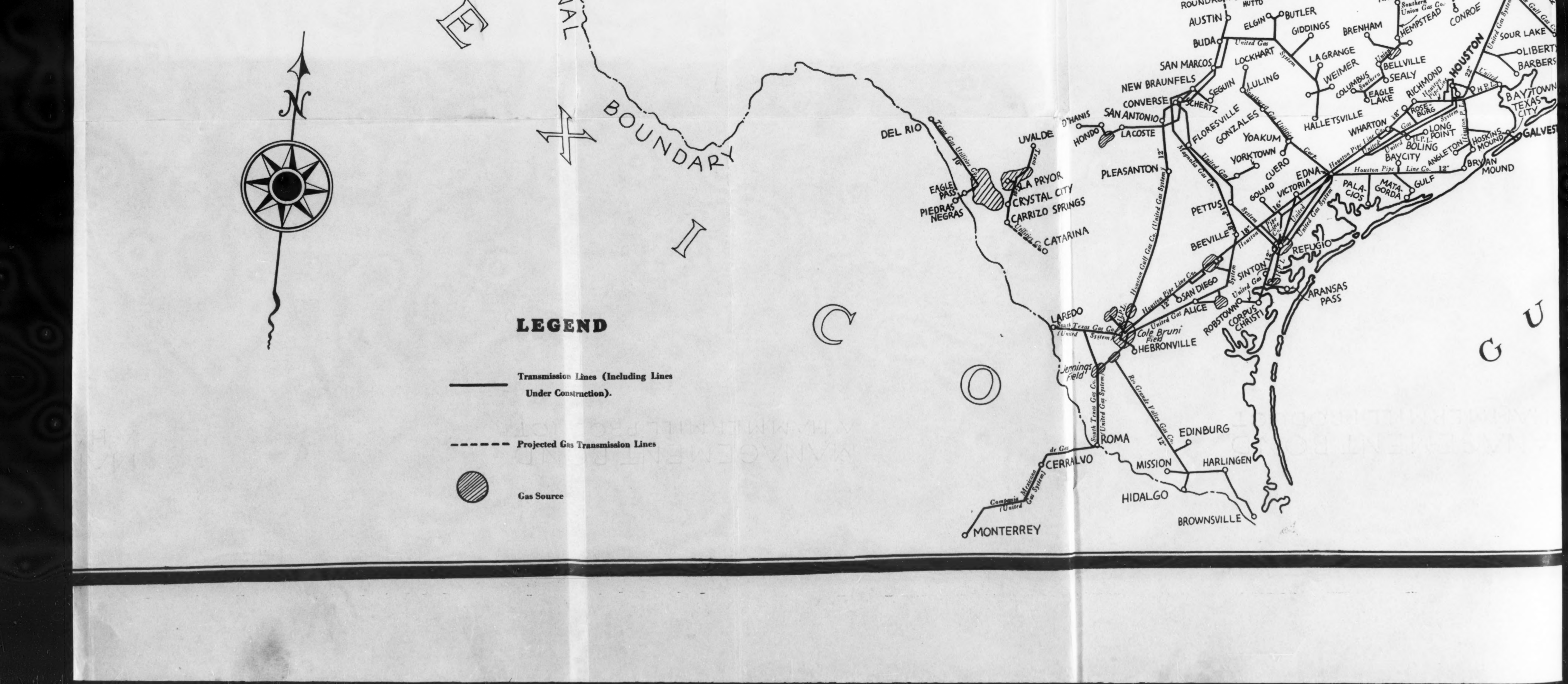
Gas Transmission Lines

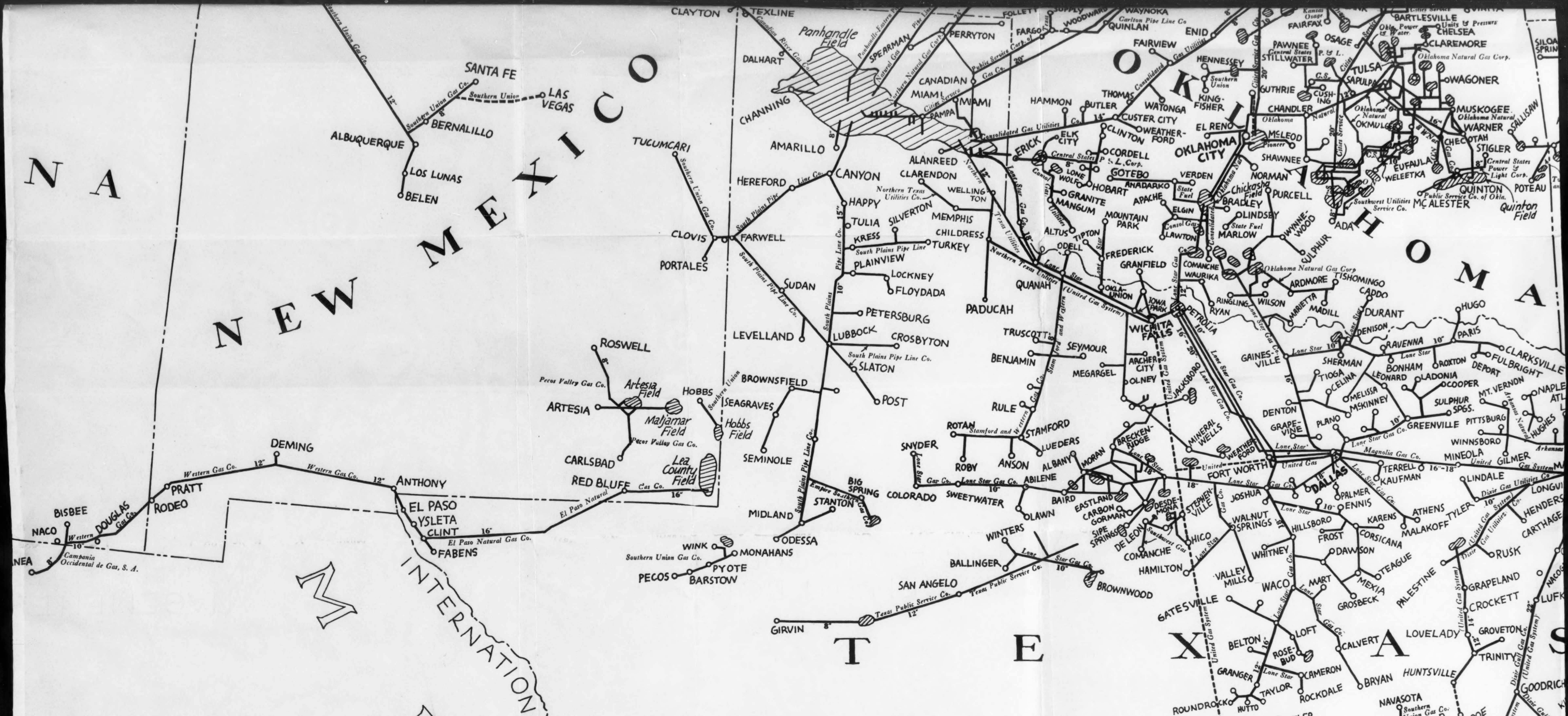
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
WYOMING
BYNUM
CONRAD
CHOTEAU
Bowes Field
MALTA
Bowdoin
SACO
Sisco Field
Utilities Co.
GLASGOW
GREAT FALLS
Northwest Steam Utilities Co.
LEWISTOWN
Lewistown Natural Gas Co.
DEER LODGE
HELENA
ANACONDA
BUTTE
WILLISTON
Montana-Dakota Power Co.
MINOT
GLENDIVE
WIBAUX
SENTINEL BUTTE
TERRY
Montana-Dakota Power
BISMARCK
MILES CITY
ISMAY
CARLYLE
BAKER
MARMARTH
BOWMAN
HETTINGER
Baker Glendive Field
BOZEMAN
LIVINGSTON
Billings Gas Co.
Lake Basin Field
COLUMBUS
BILLINGS
HARDIN
Big Horn Gas Co.
Dry Creek Field
RED LODGE
Elk Basin Field
Rocky Mountain Gas Co.
LOVELL
Lovell Gas Co.
POWELL
CODY
N. Oregon Basin
GREYBULL
BASIN
Mid-West Wyoming Gas Co.
Little Buffalo Basin Gas Co.
MANDERSON
Hidden Dome
WORLAND
Thermopolis Gas Co.
THERMOPOLIS
SHERIDAN
Northwest Steam Utilities Co.
BUFFALO
Billy Creek Field
BELLE FOURCHE
SPEARFISH
ENGLEWOOD
Osage Field
NEWCASTLE
RAPID CITY
POCATELLO
Intermountain Power Co.
FRANKLIN
PRESTON
WASHAKIE
RIVERTON
LANDER
Sand Draw Field
New York Oil Co.
North Central Gas
POWDER RIVER
MIDWEST
Mid-West Wyoming Gas Co.
CASPER
POISON SPIDER
GLENROCK
DOUGLAS
Lance Creek Field
LUSK
WERTZ
Rocky Mountain Gas Co.
CHEROKEE
FORT DODGE
SIOUX CITY
STORM


EDMONTON
12"
TOFIELD
Northwestern Utilities, Ltd.
10"
RYLEY
HOLDEN
Viking Field
BRUCE
VIKING
Wainwright Field
A N A D A
CALGARY
10"
Canadian Western Natural Gas, Light, Heat & Power Co. Ltd.
OKOTOKS
16"
Turner Valley Field
HIGH RIVER
CAYLEY
NANTON
PARKLAND
STAVELY
CLARESHOLM
16"
GRANUM
Mc CLEOD
LETHBRIDGE
CHIN
BURDETT
Bow Island Field
Many Islands Field
Medicine Hat Field
Barnwell Field
Canadian Western Natural Gas, Light, Heat & Power Co. Ltd.
Foremost Field
Red Coulee Field
Rogers Imperial Field
Kevin-Sunburst Field
Sweetgrass Hills Field
Northwest States Utilities Co.
GLACIER PARK
Cut Bank Field
CUT BANK
VALIER
SHELBY
HAVRE
CHINOOK
Montana Gas Corp.
Bowdoin-Saco Field
INTERNATIONAL BOUNDARY


COLORADO
KANSAS
NEW MEXICO
OKLAHOMA
COLORADO SPRINGS
CANON CITY
PORTLAND
PUEBLO
SUGAR CITY
FOWLER
FT. LYON
LAMAR
WILEY
GRANADA
HOLLY
SYRACUSE
LA JUNTA
LASANIMAS
THATCHER
GARDEN CITY
CIMARRON
DODGE CITY
GARFIELD
JOHNSON
ULYSSES
SPRINGFIELD
PRITCHETT
SATANTA
PLAINS
MEADE
ELKHART
HUGOTON
Hugoton Field
DURANGO
Ute Baker Field
FARMINGTON
Kutz Canyon Field
SANTA FE
LAS VEGAS
ALBUQUERQUE
BERNALILLO
LOS LUNAS
BELEN
BOISE CITY
GUYMON
HOOKER
TYRONE
TEXHOMA
CLAYTON
TEXLINE
Panhandle Field
DALHART
SPEARMAN
PERRYTON
FORGAN
BEAVER
LAVERNE
FOLLETT
FARGO
BUFFALO
SUPPLY
WOODWARD
WAYNOKA
QUINLAN
ENID
CHANNING
CANADIAN
MIAMI
PAMPA
AMARILLO
TUCUMCARI
HEREFORD
CANYON
CLARENDON
ALANREED
WELLINGTON
CLOVIS
FARWELL
PORTALES
HAPPY
TULIA
SILVERTON
MEMPHIS
CHILDRESS
KRESS
TURKEY
PLAINVIEW
LOCKNEY
FLOYDADA
SUDAN
PETERSBURG
LEVELLAND
LUBBOCK
CROSBYTON
SLATON
ROSWELL
BROWNFIELD
PADUCAH
QUANAH
TRUSCOTT
SEYMOUR
BENJAMIN
MEGARGEL
ALTUS
TIPTON
ODELL
FREDERICK
GRANFIELD
HAMMON
BUTLER
THOMAS
WATONGA
CUSTER CITY
CLINTON
WEATHERFORD
ERICK
ELK CITY
CORDELL
GOTEBO
HOBART
ANADARKO
GRANITE
MANGUM
MOUNTAIN PARK
APACHE
ELGIN
LAWTON
COMANCHE
WAURIKA
WICHITA FALLS
IOWA PARK
OKLA. UNION
RINGLING
RYAN
PETROLIA
GAINESVILLE
HENNESSEY
KINGFISHER
EL RENO
OKLAHOMA CITY
CHANDLER
GUTHRIE
CUSHING
STILLWATER
PAWNEE
FAIRVIEW
LAPORTE
MEDFORD
CHEROKEE
WELLINGTON
CALDWELL
MEDICINE LODGE
Barber County Field
COLDWATER
PROTECTION
ASHLAND
WICHITA
NEWTON
HALSTEAD
HESSTON
SEDGWICK
HUTCHINSON
PRATT
STAFFORD
ST. JOHN
GREENSBURG
MULLINVILLE
EL DORADO
AUGUSTA
EASTMAN
MULVANE
OXFORD
ARKANSAS CITY
WINFIELD
DILWORTH STA.
BLACKWELL
PONCA CITY
FAIRFAX
OSAGE
BURBANK
TULSA
SAPULPA
SHAWNEE
MCLEOD
NORMAN
PURCELL
LINDSAY
MARLOW
WYNNEWOOD
SULPHUR
ADA
ARDMORE
TISHOMINGO
CADDO
DURANT
DENISON
RAVENNA
PARIS
HUGO
CLARKSVILLE
FULBRIGHT
DEPORT
ROXTON
SHERMAN
BONHAM
LEONARD
LADONIA
WILSON
MARIETTA
MADILL
OKMULGEE
HENRYETTA
WELEETKA
EUFAULA
QUINTON
MCALESTER
POTEAU
Quinton Field
STIGLER
CHECOTAH
WARNER
GALLSBW
WAGONER
CLAREMORE
CHELSEA
VINITA
NOWATA
DELAWARE
MIAMI
COFFEEVILLE
CHETOPA
INDEPENDENCE
CANEY
CHEROKEE
PARSONS
PITTSBURG
GIRARD
PETROLIA STA.
HANUTE
YATES CENTER
MADISON
NEODESHA
FREDONIA
BURLINGTON
GARNER
MILDRED
EMPORIA
HERINGTON
ABILENE
SALINA
MCPHERSON
LYONS
MOUND RIDGE
LINCOLN
MINNEAPOLIS
BARNARD
OSBORNE
DOWNS
BELOIT
CLIFTON
CLAY CENTER
IRVING
FRANKFORT
HOLTON
HORTON
ATCHISON
KANSAS CITY
LEAVENWORTH
MANHATTAN
JUNCTION CITY
TOPEKA
LAWRENCE
OTTAWA
LYNDON
OSKALOOSA
MERIDEN
MERRIAM
FT. SCOTT
GARLAND
LA CROSSE
RUSSELL
VICTORIA
LURAY
ELLINWOOD
Panhandle Field
Hugoton Field
Barber County Field
Quinton Field

SOUTH DAKOTA
NEBRASKA
WYOMING
Elk Basin Field
Rocky Mountain Gas Co.
LOVELL
Lovell Gas Co.
POWELL
CODY
Rocky Mountain Gas Co.
N. Oregon Basin
GREYBULL
Big Horn Gas Co.
Little Buffalo Basin
MANDERSON
Hidden Dome
WORLAND
Thermopolis Gas Co.
THERMOPOLIS
SHERIDAN
Northwest Gas Co.
BUFFALO
Billy Creek Field
Western Dakota Power Co.
BELLE FOURCHE
SPEARFISH
ENGLEWOOD
RAPID CITY
Osage Field
NEWCASTLE
POCATELLO
Pacific Power & Light Co.
FRANKLIN
PRESTON
LOGAN
BRIGHAM
OGDEN
Wasatch Gas Co.
EVANSTON
Uinta Pipe Line Co.
RUSH SPRINGS
North Baxter Basin
S. Baxter Basin
Mountain Fuel Supply Co.
LYMAN
COALVILLE
SALT LAKE CITY
SANDY
PROVO
Clay Basin Field
Hiawatha Dome
WASHAKIE
RIVERTON
LANDER
New York Oil Co.
North Central Gas Co.
Sand Draw Field
POWDER RIVER
MIDWEST
Mid-West Wyoming Gas Co.
CASPER
POISON SPIDER
GLENROCK
DOUGLAS
Lance Creek Field
LUSK
WERTZ
Rocky Mountain Gas Co.
Mahoney Dome
RAWLINS
GUERNSEY
North Central Gas Co.
WHEATLAND
TORRINGTON
North Central Gas Co.
ALLIANCE
SCOTTSBLUFF
LARAMIE
North Central
FT. WARREN
CHEYENNE
FT. COLLINS
LOVELAND
GREELEY
LA SALLE
BERTHOOD
JOHNSTOWN
BOULDER
FT. LUPTON
BRIGHTON
GOLDEN
DENVER
FITZSIMONS
AURORA
LITTLETON
CHEROKEE
STORM LAKE
FORT DODGE
SIOUX CITY
Northern Natural Gas Co.
OMAHA
COUNCIL BLUFFS
PLATTSMOUTH
Natural Gas Pipe Line Co.
LINCOLN
GRAND ISLAND
YORK
AURORA
KEARNEY
SHELTON
HOLDREGE
Nebraska Natural Gas Co.
CLAY CENTER
HEBRON
BEATRICE
FALLS CITY
SUPERIOR
LEBANON
FORMOSA
MARYSVILLE
SABETHA
SENECA
FRANKFORT
HIAWATHA
ST. JOSEP
Cities Service


MEXICO
INTERNATIONAL BOUNDARY
LEGEND
Transmission Lines (Including Lines Under Construction).
Projected Gas Transmission Lines
Gas Source
DEL RIO
EAGLE PASS
PIEDRAS NEGRAS
UVALDE
LA PRYOR
CRYSTAL CITY
CARRIZO SPRINGS
CATARINA
D'HANIS
HONDO
LACOSTE
SAN ANTONIO
CONVERSE
SCHERTZ
SEGUIN
NEW BRAUNFELS
SAN MARCOS
LOCKHART
LULING
FLORESVILLE
GONZALES
PLEASANTON
YOAKUM
YORKTOWN
CUERO
GOLIAD
VICTORIA
EDNA
PETTUS
BEEVILLE
SINTON
REFUGIO
ARANSAS PASS
SAN DIEGO
ALICE
ROBSTOWN
CORPUS CHRISTI
LAREDO
Cole Bruni Field
HEBRONVILLE
Jennings Field
ROMA
CERRALVO
MISSION
HARLINGEN
EDINBURG
HIDALGO
BROWNSVILLE
MONTERREY
AUSTIN
ELGIN
BUTLER
GIDDINGS
BUDA
LAGRANGE
WEIMER
BRENHAM
HEMPSTEAD
BELLVILLE
SEALY
EAGLE LAKE
COLUMBUS
HALLETSVILLE
WHARTON
ROSEBURG
LONG POINT
BOLING
BAY CITY
ANGLETON
HOUSTON
CONROE
RICHMOND
SOUR LAKE
LIBERTY
BARBERS
BAYTOWN
TEXAS CITY
GALVESTON
HOSKINS MOUND
BRYAN MOUND
PALACIOS
MATAGORDA
GULF
GULF


NEW MEXICO
TEXAS
OKLAHOMA
INTERNATION
CLAYTON
TEXLINE
DALHART
CHANNING
AMARILLO
Panhandle Field
SPEARMAN
PERRYTON
CANADIAN
MIAMI
PAMPA
SANTA FE
LAS VEGAS
BERNALILLO
ALBUQUERQUE
LOS LUNAS
BELEN
TUCUMCARI
CLOVIS
PORTALES
FARWELL
HEREFORD
CANYON
HAPPY
TULIA
KRESS
SILVERTON
PLAINVIEW
LOCKNEY
FLOYDADA
SUDAN
LEVELLAND
LUBBOCK
PETERSBURG
CROSBYTON
SLATON
POST
BROWNSFIELD
SEAGRAVES
SEMINOLE
ROSWELL
ARTESIA
Artesia Field
Maljamar Field
HOBBS
Hobbs Field
CARLSBAD
Lea County Field
RED BLUFF
DEMING
ANTHONY
EL PASO
YSLETA
CLINT
FABENS
PRATT
RODEO
DOUGLAS
BISBEE
NACO
Campania Occidental de Gas, S. A.
Western Gas Co.
El Paso Natural Gas Co.
South Plains Pipe Line Co.
Southern Union Gas Co.
Pecos Valley Gas Co.
Texas Public Service Co.
Lone Star Gas Co.
United Gas System
Oklahoma Natural Gas Corp.
Cities Service Gas Co.
Consolidated Gas Utilities Co.
Northern Natural Gas Corp.
Panhandle-Eastern Pipe Line
Northern Texas Utilities Co.
Dixie Gulf Gas Co.
Dixie Gas Utilities Co.
Public Service Co. of Okla.
Central States Power & Light Corp.
Southwest Utilities Service Co.
Magnolia Gas Co.
Stamford and Western Gas Co.
Empire Southern Gas Co.
Carlton Pipe Line Co
WINK
MONAHANS
PYOTE
BARSTOW
PECOS
MIDLAND
ODESSA
STANTON
BIG SPRING
COLORADO
SNYDER
GIRVIN
SAN ANGELO
BALLINGER
WINTERS
BROWNWOOD
ROTAN
ROBY
SWEETWATER
ANSON
ABILENE
STAMFORD
LUEDERS
ALBANY
LAWN
BAIRD
MORAN
BRECKENRIDGE
EASTLAND
CARBON
GORMAN
SIPE SPRINGS
DE LEON
DESDEMONA
COMANCHE
HAMILTON
HICO
STEPHENVILLE
GATESVILLE
RULE
BENJAMIN
TRUSCOTT
SEYMOUR
MEGARGEL
ARCHER CITY
OLNEY
PADUCAH
CHILDRESS
MEMPHIS
WELLINGTON
CLARENDON
ALANREED
TURKEY
QUANAH
ODELL
OKLAUNION
WICHITA FALLS
IOWA PARK
PETROLIA
JACKSBORO
MINERAL WELLS
WEATHERFORD
FORT WORTH
JOSHUA
WALNUT SPRINGS
VALLEY MILLS
WHITNEY
HILLSBORO
WACO
MART
BELTON
ROSEBUD
LOFT
CALVERT
CAMERON
ROCKDALE
BRYAN
GRANGER
TAYLOR
HUTTO
ROUNDROCK
NAVASOTA
HUNTSVILLE
LOVELADY
TRINITY
GROVETON
CROCKETT
GRAPELAND
PALESTINE
RUSK
TEAGUE
MEXIA
GROSBECK
DAWSON
CORSICANA
FROST
KARENS
ENNIS
PALMER
DALLAS
TERRELL
KAUFMAN
ATHENS
MALAKOFF
TYLER
LINDALE
MINEOLA
WINNSBORO
GILMER
LONGVIEW
HENDERSON
CARTHAGE
GOODRICH
LUFKIN
NACOGDOCHES
DENTON
GRAPEVINE
PLANO
GAINESVILLE
TIOGA
CELINA
MELISSA
McKINNEY
SHERMAN
DENISON
LEONARD
BONHAM
LADONIA
COOPER
GREENVILLE
SULPHUR SPGS.
PITTSBURG
MT. VERNON
RAVENNA
ROXTON
DEPORT
PARIS
CLARKSVILLE
FULBRIGHT
HUGO
DURANT
CADDO
TISHOMINGO
ARDMORE
MADILL
MARIETTA
WILSON
RINGLING
RYAN
WAURIKA
COMANCHE
LAWTON
MARLOW
LINDSEY
WYNNEWOOD
SULPHUR
ADA
PURCELL
NORMAN
BRADLEY
Chickasha Field
ELGIN
APACHE
ANADARKO
VERDEN
MOUNTAIN PARK
FREDERICK
GRANFIELD
TIPTON
ALTUS
MANGUM
GRANITE
HOBART
LONE WOLF
GOTEBO
CORDELL
CLINTON
WEATHERFORD
CUSTER CITY
BUTLER
HAMMON
ELK CITY
ERICK
THOMAS
WATONGA
KINGFISHER
EL RENO
OKLAHOMA CITY
SHAWNEE
McLEOD
HENNESSEY
FAIRVIEW
ENID
WAYNOKA
QUINLAN
WOODWARD
FARGO
FOLLETT
GUTHRIE
CHANDLER
STILLWATER
PAWNEE
CUSHING
FAIRFAX
OSAGE
TULSA
SAPULPA
OKMULGEE
BARTLESVILLE
CHELSEA
CLAREMORE
WAGONER
MUSKOGEE
WARNER
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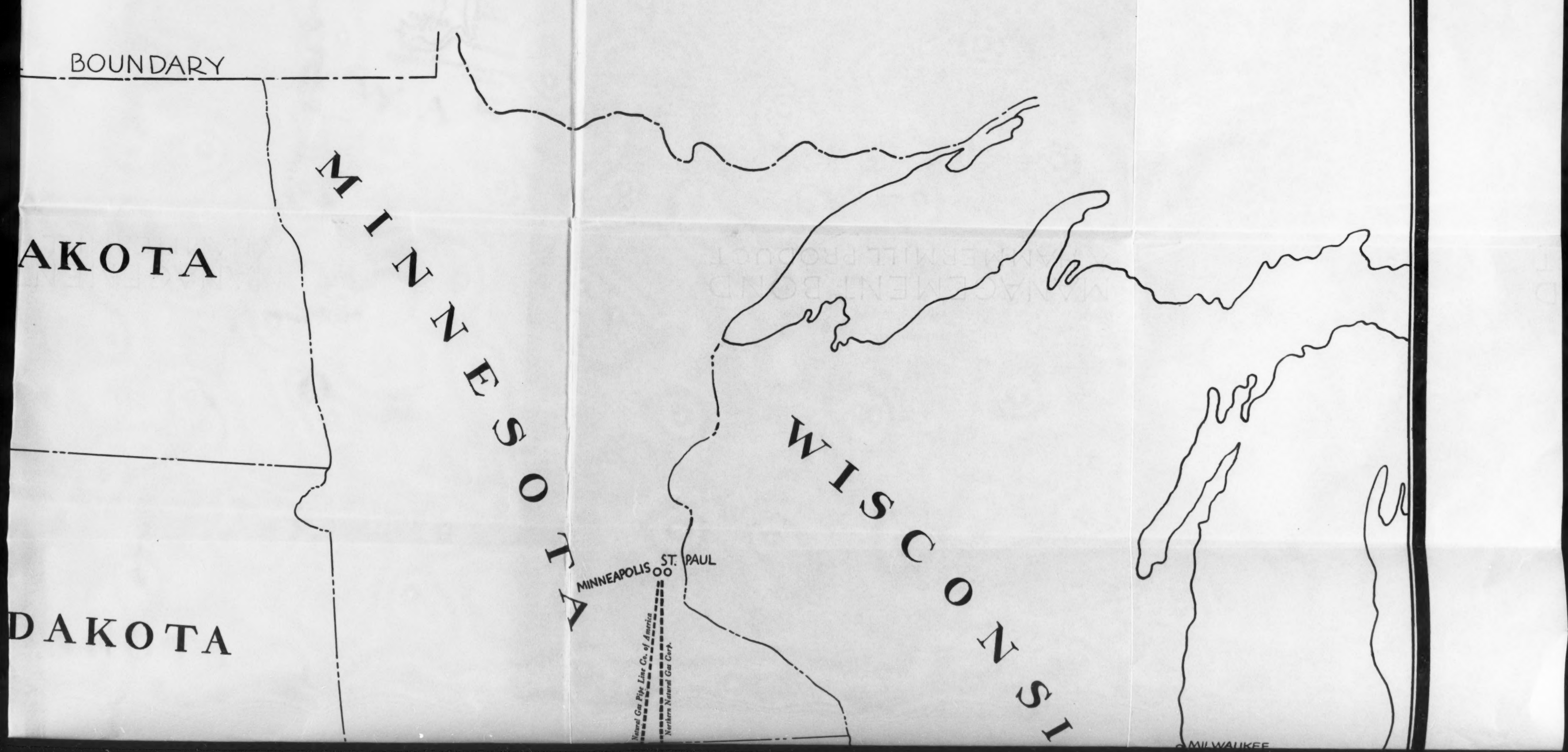
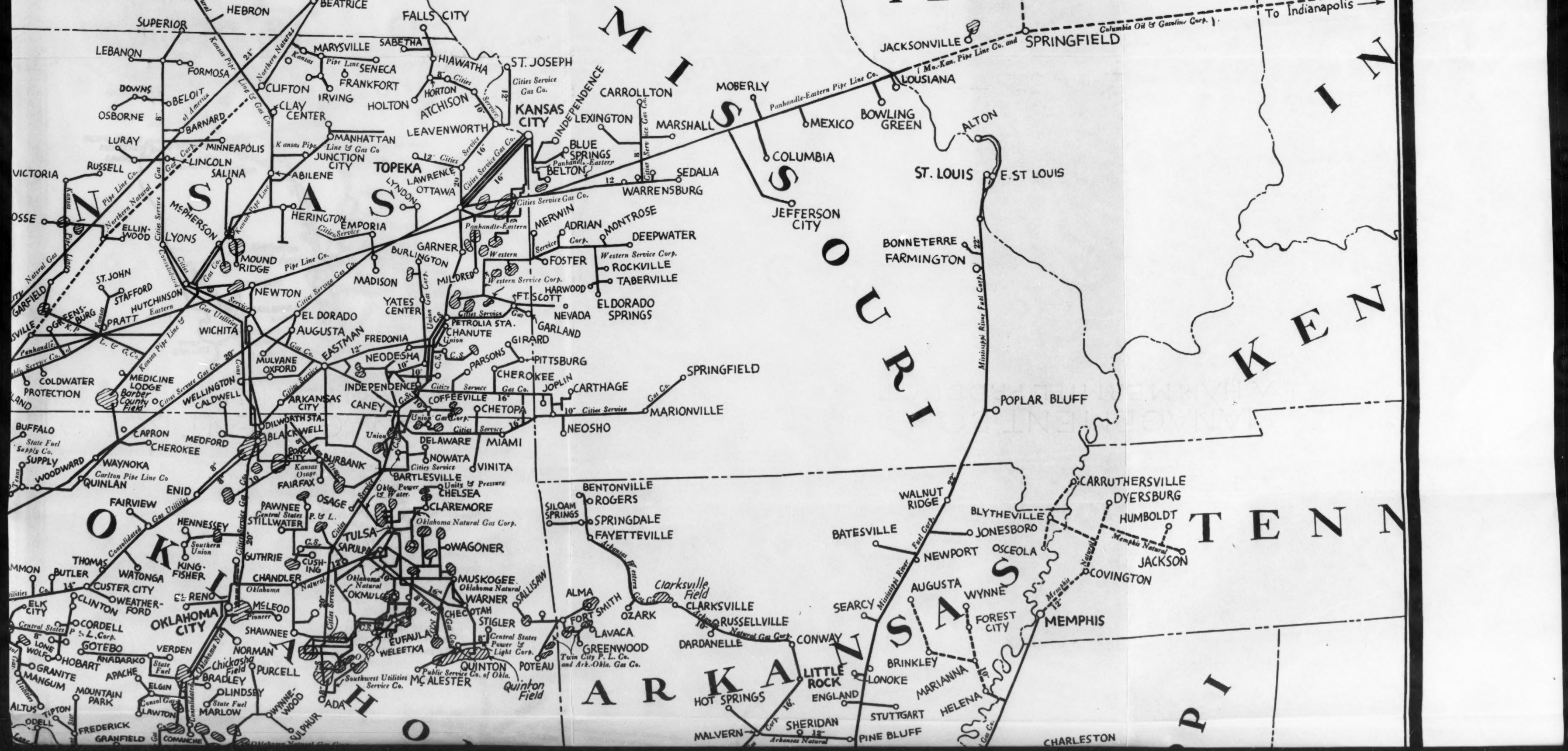
STIGLER
SALLISAW
QUINTON
McALESTER
Quinton Field
POTEAU
SILOAM SPRINGS


BOUNDARY
AKOTA
DAKOTA
MINNESOTA
WISCONSI
MINNEAPOLIS
ST. PAUL
MILWAUKEE
Natural Gas Pipe Line Co. of America
Northern Natural Gas Corp.

D A


To Indianapolis
JACKSONVILLE
SPRINGFIELD
Columbia Oil & Gasoline Corp.
Mo.-Kan. Pipe Line Co. and
LOUISIANA
Panhandle-Eastern Pipe Line Co.
MOBERLY
MEXICO
BOWLING GREEN
ALTON
ST. LOUIS
E. ST LOUIS
COLUMBIA
JEFFERSON CITY
BONNETERRE
FARMINGTON
POPLAR BLUFF
MISSOURI
KENTUCKY
TENNESSEE
ARKANSAS
OKLAHOMA
KANSAS
SUPERIOR
HEBRON
BEATRICE
FALLS CITY
LEBANON
FORMOSA
MARYSVILLE
SABETHA
HIAWATHA
ST. JOSEPH
SENECA
FRANKFORT
CLIFTON
IRVING
HORTON
ATCHISON
HOLTON
CLAY CENTER
KANSAS CITY
INDEPENDENCE
CARROLLTON
LEXINGTON
MARSHALL
DOWNS
OSBORNE
BELOIT
BARNARD
LURAY
MINNEAPOLIS
MANHATTAN
JUNCTION CITY
LEAVENWORTH
BLUE SPRINGS
BELTON
SEDALIA
WARRENSBURG
VICTORIA
RUSSELL
LINCOLN
SALINA
ABILENE
TOPEKA
LAWRENCE
OTTAWA
LYNDON
HERINGTON
EMPORIA
MERWIN
ADRIAN
MONTROSE
DEEPWATER
OSSE
MEPHERSON
LYONS
ELLINWOOD
MOUND RIDGE
GARNER
BURLINGTON
MADISON
MILDRED
FOSTER
ROCKVILLE
TABERVILLE
ELDORADO SPRINGS
HARWOOD
FT. SCOTT
NEVADA
YATES CENTER
NEWTON
ST. JOHN
STAFFORD
HUTCHINSON
PRATT
GREENSBURG
GARFIELD
EL DORADO
AUGUSTA
WICHITA
PETROLIA STA.
CHANUTE
GIRARD
GARLAND
EASTMAN
FREDONIA
NEODESHA
MULVANE
OXFORD
PARSONS
PITTSBURG
CHEROKEE
JOPLIN
CARTHAGE
SPRINGFIELD
MARIONVILLE
NEOSHO
COLDWATER
PROTECTION
MEDICINE LODGE
Barber County Field
WELLINGTON
CALDWELL
INDEPENDENCE
COFFEEVILLE
CHETOPA
CANEY
ARKANSAS CITY
DILWORTH STA.
BLACKWELL
BUFFALO
CAPRON
CHEROKEE
MEDFORD
DELAWARE
NOWATA
MIAMI
VINITA
BURBANK
SUPPLY
WOODWARD
WAYNOKA
QUINLAN
ENID
FAIRFAX
BARTLESVILLE
CHELSEA
CLAREMORE
FAIRVIEW
OSAGE
PAWNEE
STILLWATER
HENNESSEY
TULSA
SAPULPA
WAGONER
BENTONVILLE
ROGERS
SILOAM SPRINGS
SPRINGDALE
FAYETTEVILLE
WALNUT RIDGE
BLYTHEVILLE
CARRUTHERSVILLE
DYERSBURG
HUMBOLDT
JACKSON
BATESVILLE
JONESBORO
NEWPORT
OSCEOLA
COVINGTON
MEMPHIS
AUGUSTA
WYNNE
SEARCY
FOREST CITY
THOMAS
WATONGA
BUTLER
CUSTER CITY
KINGFISHER
GUTHRIE
CUSHING
CHANDLER
MUSKOGEE
WARNER
CHECOTAH
STIGLER
SPAVINAW
ALMA
FORT SMITH
OZARK
LAVACA
GREENWOOD
Clarksville Field
CLARKSVILLE
RUSSELLVILLE
DARDANELLE
CONWAY
LITTLE ROCK
ENGLAND
STUTTGART
BRINKLEY
LONOKE
MARIANNA
HELENA
HOT SPRINGS
MALVERN
SHERIDAN
PINE BLUFF
CHARLESTON
EL RENO
OKLAHOMA CITY
McLEOD
SHAWNEE
NORMAN
PURCELL
CHICKASHA Field
BRADLEY
LINDSEY
MARLOW
WYNNEWOOD
SULPHUR
ADA
EUFAULA
WELEETKA
QUINTON
McALESTER
POTEAU
Quinton Field
CLINTON
WEATHERFORD
ELK CITY
CORDELL
GOTEBO
HOBART
ANADARKO
VERDEN
LONE WOLF
GRANITE
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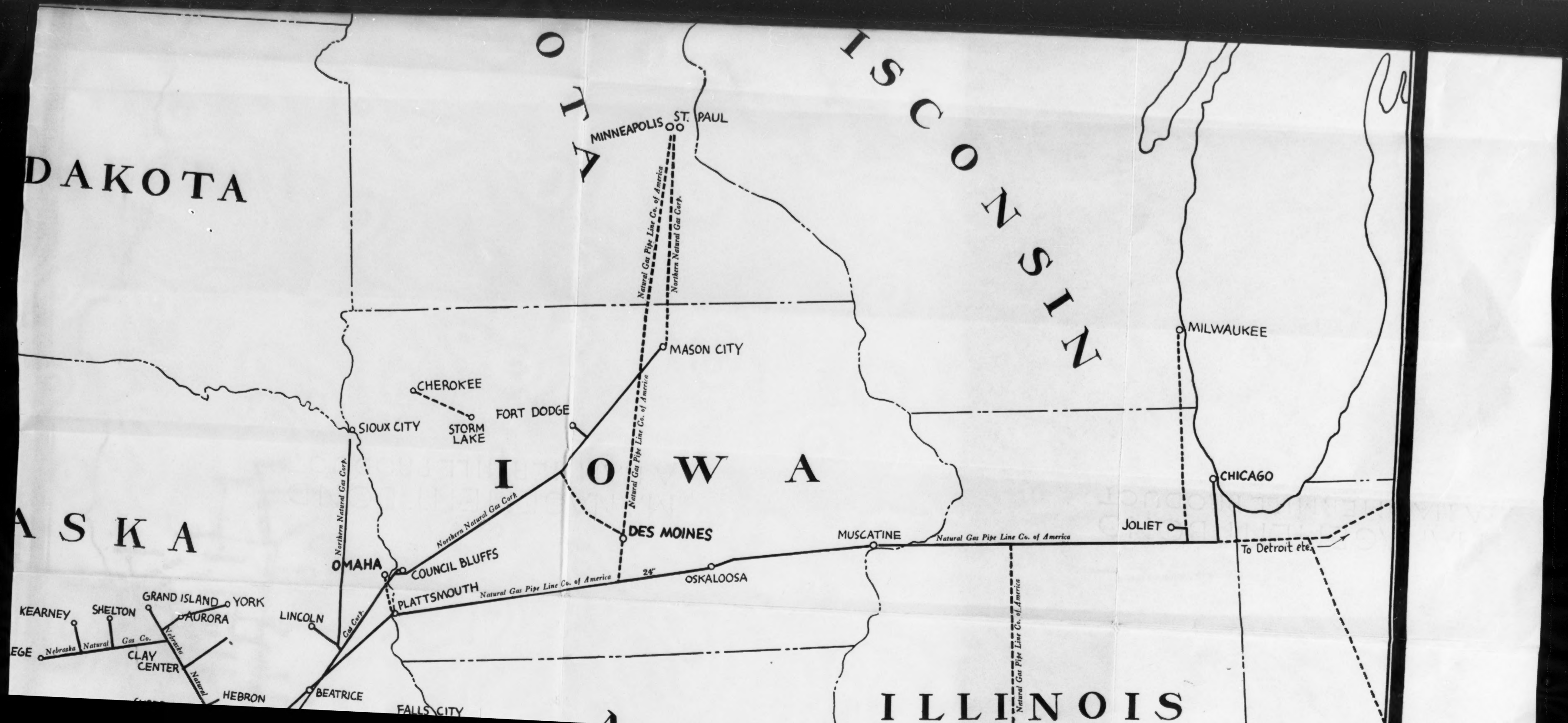
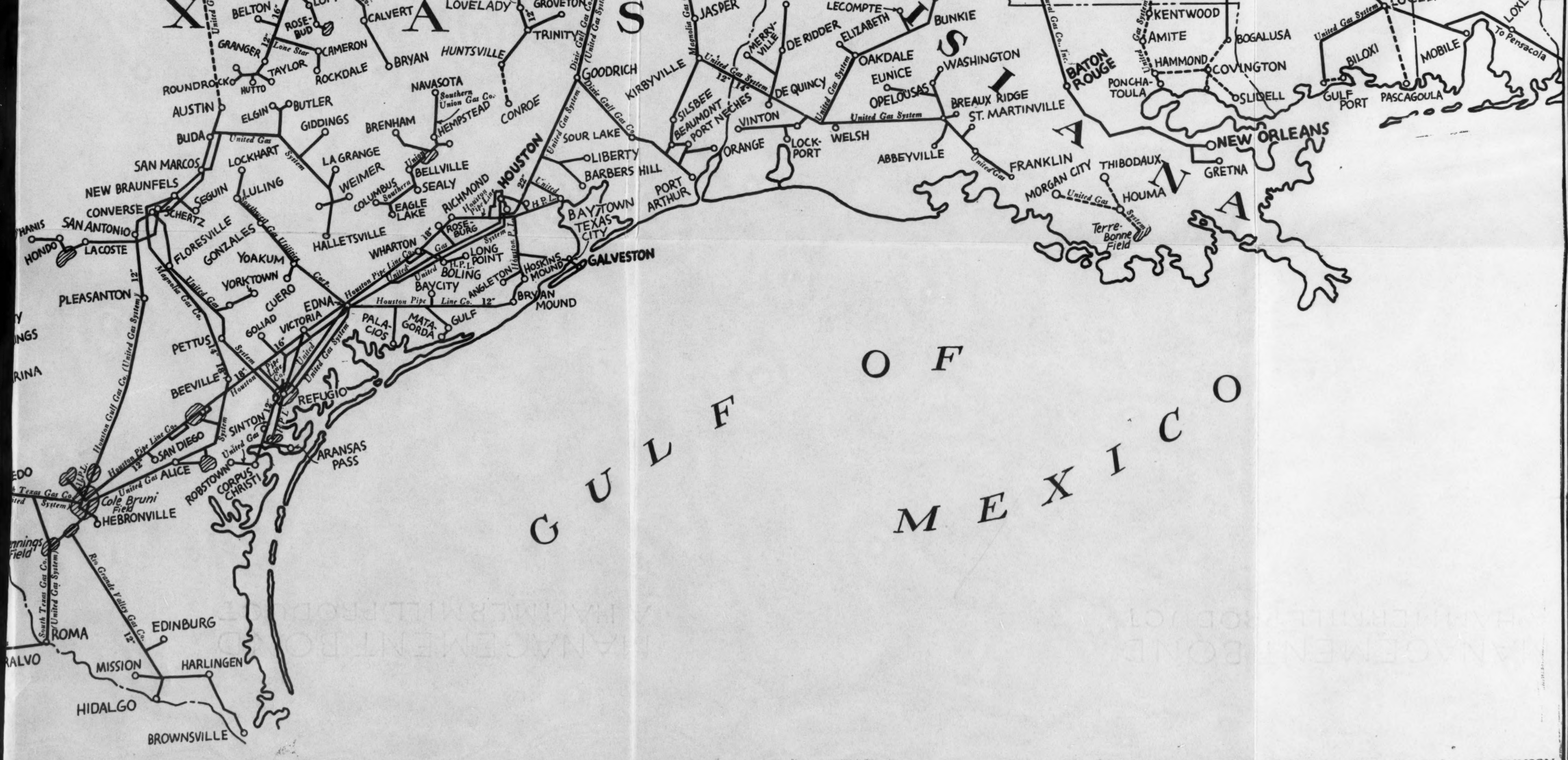
LAWTON
MOUNTAIN PARK
ALTUS
TIPTON
FREDERICK
GRANFIELD
COMANCHE
ODELL


DAKOTA
ASKA
MINNESOTA
WISCONSIN
IOWA
ILLINOIS
MINNEAPOLIS
ST. PAUL
MILWAUKEE
CHICAGO
JOLIET
MASON CITY
CHEROKEE
FORT DODGE
STORM LAKE
SIOUX CITY
DES MOINES
OMAHA
COUNCIL BLUFFS
PLATTSMOUTH
MUSCATINE
OSKALOOSA
To Detroit etc.
Natural Gas Pipe Line Co. of America
Northern Natural Gas Corp.
24"
KEARNEY
SHELTON
GRAND ISLAND
YORK
AURORA
LINCOLN
CLAY CENTER
HEBRON
BEATRICE
FALLS CITY
Nebraska Natural Gas Co.
Nebraska Natural Gas Co.
Gas Corp.



COMPILED BY R. C. COLLING — DRAWN BY J. S. JOHNSON

OKLAHOMA
ARKANSAS
MISSISSIPPI
TENN
ALA
OKLAHOMA CITY
TULSA
FORT WORTH
DALLAS
SHREVEPORT
LITTLE ROCK
MEMPHIS
HOT SPRINGS
PINE BLUFF
MONROE
VICKSBURG
JACKSON
MERIDIAN
NATCHEZ
GREENWOOD
GREENVILLE
CLARKSVILLE
FORT SMITH
TEXARKANA
ATLANTA
NACOGDOCHES
TYLER
WACO
ABILENE
WICHITA FALLS
DENTON
PARIS
DURANT
ARDMORE
ENID
WOODWARD
GUTHRIE
CHICKASHA
LAWTON
ADA
MUSKOGEE
BARTLESVILLE
BENTONVILLE
ROGERS
SPRINGDALE
FAYETTEVILLE
JONESBORO
BLYTHEVILLE
WALNUT RIDGE
BATESVILLE
NEWPORT
OSCEOLA
CARRUTHERSVILLE
DYERSBURG
HUMBOLDT
JACKSON
COVINGTON
AUGUSTA
WYNNE
FORREST CITY
SEARCY
CONWAY
RUSSELLVILLE
DARDANELLE
BRINKLEY
MARIANNA
HELENA
LONOKE
STUTTGART
ENGLAND
MALVERN
SHERIDAN
ARKADELPHIA
NASHVILLE
PRESCOTT
GURDON
HOPE
ASHDOWN
FORDYCE
STAR CITY
MCGEHEE
DERMOTT
HAMBURG
LAKE VILLAGE
WARREN
STRONG
EL DORADO
HAYNESVILLE
STEPHENS
COLUMBIA
OAK GROVE
LAKE PROVIDENCE
BASTROP
DELHI
TALLULAH
SICILY ISLAND
CHARLESTON
GRENADA
WINONA
WEST POINT
COLUMBUS
STARKVILLE
MACON
DURANT
YAZOO CITY
KOSCIUSCO
TERRY
MENDENHALL
LAUREL
HATTIESBURG
FERNWOOD
MAGNOLIA
COLUMBIA
KENTWOOD
LUCEDALE
LOXLEY
BUNKIE
MARKSVILLE
ALEXANDRIA
LECOMPTE
LEESVILLE
JASPER
LUFKIN
CROCKETT
GROVETON
GRAPELAND
PALESTINE
RUSK
HENDERSON
LONGVIEW
MARSHALL
CARTHAGE
GARRISON
CENTER
SAN AUGUSTINE
ZWOLLE
MANY
WINNFIELD
RINGGOLD
HOMER
BERNICE
MINDEN
RUSTON
ARCADIA
MONROE
WINNSBORO
MINEOLA
TERRELL
KAUFMAN
PALMER
ENNIS
ATHENS
MALAKOFF
CORSICANA
FROST
HILLSBORO
WHITNEY
VALLEY MILLS
MEXIA
TEAGUE
DAWSON
GROSBECK
LOVELADY
BELTON
LOFT
CALVERT
BROWNWOOD
HAMILTON
COMANCHE
DE LEON
EASTLAND
CARBON
GORMAN
SIPE SPRINGS
STEPHENVILLE
DESDEMONA
BAIRD
CISCO
ABILENE
MORAN
ALBANY
BRECKENRIDGE
MINERAL WELLS
WEATHERFORD
JACKSBORO
OLNEY
MEGARGEL
SEYMOUR
ARCHER CITY
GRANFIELD
FREDERICK
ELK CITY
CLINTON
WEATHERFORD
CORDELL
GOTEBO
HOBART
ANADARKO
VERDEN
NORMAN
SHAWNEE
MCLEOD
CHANDLER
KINGFISHER
WATONGA
CUSTER CITY
BUTLER
THOMAS
FAIRVIEW
HENNESSEY
CAPRON
CHEROKEE
MEDFORD
BUFFALO
SUPPLY
WAYNOKA
QUINLAN
ENID
OSAGE
PAWNEE
STILLWATER
CUSHING
DRUMRIGHT
SAPULPA
OWASSO
COLLINSVILLE
SKIATOOK
BARNSDALL
BURBANK
FAIRFAX
BLACKWELL
DILWORTH STA.
CHETOPA
NEOSHO
MARIONVILLE
DELAWARE
NOWATA
VINITA
MIAMI
SILOAM SPRINGS
ALMA
OZARK
LAVACA
GREENWOOD
QUINTON
POTEAU
MCALESTER
STIGLER
CHECOTAH
WARNER
SALLISAW
OKMULGEE
EUFAULA
WELEETKA
OKEMAH
PRAGUE
CHANDLER
MARLOW
DUNCAN
ELGIN
LAWTON
COMANCHE
WAURIKA
ALTUS
TIPTON
ODELL
GRANITE
MANGUM
MOUNTAIN PARK
APACHE
ELGIN
LONE WOLF
CHICKASHA
BRADLEY
PURCELL
LINDSEY
WYNNEWOOD
SULPHUR
TISHOMINGO
CADDO
DURANT
DENISON
SHERMAN
GAINESVILLE
RINGLING
RYAN
WILSON
MARIETTA
MADILL
IOWA PARK
PETROLIA
OKLA-UNION
HUGO
PARIS
CLARKSVILLE
FULBRIGHT
DEPORT
ROXTON
RAVENNA
BONHAM
LEONARD
TIOGA
CELINA
MELISSA
MCKINNEY
PLANO
GRAPEVINE
DENTON
LADONIA
COOPER
SULPHUR SPGS.
MT. VERNON
NAPLES
ATLANTA
LINDEN
CADDO FIELD
HUGHES
PITTSBURG
GREENVILLE
KAUFMAN
TERRELL
LINDALE
JOSHUA
WALNUT SPRINGS
HICO
STEPHENVILLE
GATESVILLE
MART
WACO
LORENA
MARLIN
ROSEBUD
TEMPLE
BELTON
GRANGER
TAYLOR
ROUND ROCK
AUSTIN
SAN MARCOS
LULING
GONZALES
SEGUIN
NEW BRAUNFELS
SAN ANTONIO
KERRVILLE
FREDERICKSBURG
BOERNE
HONDO
D'HANIS
CASTROVILLE
YOAKUM
VICTORIA
GOLIAD
BEEVILLE
PLEASANTON
JOURDANTON
POTEET
PEARSALL
CARRIZO SPRINGS
CRYSTAL CITY
UVALDE
SABINOSO
EAGLE PASS
DEL RIO
BRACKETTVILLE
HONDO
LA PRYOR
CHARLOTTE
ASHERTON
DILLEY
CATARINA
ARTESIA WELLS
DHANIS
LA SALLE
MCMULLEN
LIVE OAK
BEE
GOLIAD
REFUGIO
ARANSAS PASS
CORPUS CHRISTI
ROCKPORT
PORTLAND
ALICE
KINGSVILLE
RIVIERA
BISHOP
ODEM
SINTON
TAFT
GREGORY
PORTLAND
ROBSTOWN
AGUA DULCE
PETTUS
KARNES CITY
FALLS CITY
PLEASANTON
JOURDANTON
POTEET
PEARSALL
CARRIZO SPRINGS
CRYSTAL CITY
UVALDE
SABINOSO
EAGLE PASS
DEL RIO
BRACKETTVILLE
HONDO
LA PRYOR
CHARLOTTE
ASHERTON
DILLEY
CATARINA
ARTESIA WELLS
DHANIS
LA SALLE
MCMULLEN
LIVE OAK
BEE
GOLIAD
REFUGIO
ARANSAS PASS
CORPUS CHRISTI
ROCKPORT
PORTLAND
ALICE
KINGSVILLE
RIVIERA
BISHOP
ODEM
SINTON
TAFT
GREGORY
PORTLAND
ROBSTOWN
AGUA DULCE
PETTUS
KARNES CITY
FALLS CITY
Clarksville Field
Quinton Field
Waskom Field
Richland Field
Monroe Field
East Carroll Field
Caddo Field
Sabine Gas Co.
Gulf States Utilities Co.
Southwestern Gas Utilities Co.
Southern Natural Gas Corp.
To Birmingham, Atlanta, etc.
Memphis Natural Gas Co.
Arkansas Natural
Arkansas Natural Gas Corp.
Lone Star Gas Co.
United Gas System
Oklahoma Natural Gas Corp.
Cities Service
Southwestern Gas Utilities Co.
Twin City P. L. Co. and Ark.-Okla. Gas Co.
Public Service Co. of Okla.
Southwest Utilities Service Co.
Central States Power & Light Corp.
Empire So. Gas Co.
Mississippi River Fuel Corp.
Memphis Natural Gas Co.
Southern Natural Gas Corp.
Intrastate Natural Gas Co.
Southern Gas Lines, Inc.
Dixie Gas Utilities Co.
Magnolia Gas Co.
Texarkana Natural
Stephens Arkansas Natural
Haynesville
Arkansas Natural
Arkansas Natural Gas Corp.
Southern Natural Gas Corp.
Memphis Natural Gas Co.
Mississippi River Fuel Corp.
Intrastate Natural Gas Co.
Southern Gas Lines, Inc.
Dixie Gas Utilities Co.
Magnolia Gas Co.
Texarkana Natural
Stephens Arkansas Natural
Haynesville

ORIFICE METER SPECIFIC GRAVITY CORRECTION FACTORS FOR LIQUIDS

Sheet 2

PETROLEUM GROUP	°A.P.I. @ 60°F	SPECIFIC GRAVITY @60°F = G_{60} BASED ON WATER @ 60°F=1.000	ORIFICE METER FACTORS: DIAPHRAGM TYPE GAUGES FACTOR = $\frac{1}{\sqrt{G_{60}}}$	MERCURY TYPE GAUGES: NO SEAL FACTOR = $\frac{1}{\sqrt{G_{60}\left(\frac{G_{60}}{13.58}\right)}}$	MERCURY TYPE GAUGES: WATER SEAL LARGE AREA FACTOR = $\frac{1}{\sqrt{G_{60}\left(\frac{1}{13.58}\right)}}$
Group X	79.0	.6722	1.2197	1.1891	1.1739
	79.5	.6706	1.2211	1.1906	1.1753
	80.0	.6690	1.2226	1.1920	1.1767
	80.5	.6675	1.2240	1.1935	1.1780
	81.0	.6659	1.2254	1.1950	1.1794
	81.5	.6643	1.2269	1.1965	1.1809
	82.0	.6628	1.2285	1.1980	1.1822
	82.5	.6612	1.2298	1.1995	1.1836
	83.0	.6597	1.2312	1.2009	1.1850
	83.5	.6581	1.2327	1.2024	1.1864
	84.0	.6566	1.2341	1.2039	1.1878
	84.5	.6551	1.2355	1.2053	1.1891
	85.0	.6536	1.2369	1.2068	1.1905
	85.5	.6521	1.2383	1.2082	1.1919
	86.0	.6506	1.2398	1.2098	1.1933
	86.5	.6491	1.2412	1.2112	1.1946
	87.0	.6476	1.2427	1.2128	1.1960
	87.5	.6461	1.2441	1.2141	1.1974
	88.0	.6446	1.2455	1.2156	1.1988
	88.5	.6432	1.2469	1.2170	1.2001
Group XI	89.0	.6417	1.2484	1.2186	1.2015
	89.5	.6403	1.2497	1.2199	1.2028
	90.0	.6388	1.2510	1.2212	1.2042
	90.5	.6374	1.2526	1.2228	1.2056
	91.0	.6360	1.2539	1.2242	1.2069
	91.5	.6345	1.2554	1.2257	1.2083
	92.0	.6331	1.2568	1.2271	1.2096
	92.5	.6317	1.2582	1.2286	1.2110
	93.0	.6303	1.2596	1.2300	1.2123
	93.5	.6289	1.2610	1.2314	1.2137
	94.0	.6275	1.2624	1.2329	1.2150
	94.5	.6261	1.2638	1.2343	1.2164
	95.0	.6247	1.2652	1.2357	1.2177
	95.5	.6233	1.2666	1.2372	1.2191
	96.0	.6220	1.2680	1.2386	1.2204
	96.5	.6206	1.2694	1.2400	1.2218
	97.0	.6193	1.2707	1.2414	1.2230
	97.5	.6179	1.2722	1.2429	1.2244
	98.0	.6166	1.2736	1.2443	1.2257
	98.5	.6152	1.2749	1.2457	1.2271
	99.0	.6139	1.2763	1.2471	1.2284
	99.5	.6126	1.2776	1.2485	1.2297
	100.0	.6112	1.2791	1.2500	1.2311
	100.5	.6099	1.2805	1.2514	1.2324
	101.0	.6086	1.2818	1.2528	1.2337
	101.5	.6073	1.2832	1.2542	1.2351
	102.0	.6060	1.2846	1.2556	1.2364
	102.5	.6047	1.2860	1.2570	1.2377
	103.0	.6034	1.2874	1.2585	1.2391
	103.5	.6021	1.2887	1.2598	1.2404
	104.0	.6008	1.2901	1.2613	1.2417
Group XI	104.5	.5996	1.2914	1.2626	1.2430
	105.0	.5983	1.2928	1.2640	1.2443
	105.5	.5970	1.2942	1.2655	1.2457
	106.0	.5958	1.2955	1.2668	1.2469
	106.5	.5945	1.2970	1.2682	1.2483
	107.0	.5933	1.2983	1.2696	1.2496
	107.5	.5920	1.2997	1.2710	1.2509
	108.0	.5908	1.3010	1.2724	1.2522
	108.5	.5896	1.3023	1.2737	1.2536
	109.0	.5884	1.3037	1.2751	1.2548
	109.5	.5871	1.3051	1.2766	1.2561
	110.0	.5859	1.3064	1.2780	1.2574

To be used in formula:-

$$Q(\text{Gals/Hr @ } 60°F) = (340.0\ C_v d^2) \times G_f \times T_f \sqrt{h}$$

Where G_f = Gravity factor

T_f = Temperature factor

W.L.C. & E.V.

Table No. 5.

GASOLINE ORIFICE METER TEMPERATURE FACTORS (T_f)

To be used in formula:- $Q(\text{GALS/HR @ } 60°F) = (340.0\ C_v d^2) \times G_f \times T_f \sqrt{h}$ Where G_f = Gravity factor, T_f = Temperature factor

GROUP III 51 TO 63.9 DEGREES A.P.I. AT 60°F

TEMP°F	0	1	2	3	4	5	6	7	8	9
0	1.0179	1.0175	1.0173	1.0170	1.0167	1.0164	1.0161	1.0158	1.0155	1.0152
10	1.0149	1.0146	1.0143	1.0141	1.0138	1.0135	1.0132	1.0129	1.0126	1.0123
20	1.0120	1.0117	1.0114	1.0111	1.0108	1.0105	1.0102	1.0099	1.0096	1.0093
30	1.0090	1.0087	1.0084	1.0081	1.0078	1.0075	1.0072	1.0069	1.0066	1.0063
40	1.0060	1.0057	1.0054	1.0051	1.0048	1.0045	1.0042	1.0039	1.0036	1.0033
50	1.0030	1.0027	1.0024	1.0021	1.0018	1.0015	1.0012	1.0009	1.0006	1.0003
60	1.0000	.9997	.9994	.9991	.9988	.9985	.9982	.9978	.9975	.9972
70	.9969	.9966	.9963	.9960	.9957	.9954	.9951	.9948	.9945	.9942
80	.9939	.9936	.9933	.9930	.9927	.9924	.9921	.9918	.9915	.9912
90	.9909	.9906	.9903	.9899	.9896	.9893	.9890	.9887	.9884	.9881
100	.9878	.9875	.9872	.9868	.9865	.9862	.9859	.9856	.9853	.9850
110	.9847	.9844	.9841	.9838	.9835	.9832	.9829	.9825	.9822	.9819
120	.9816	.9813	.9810	.9807	.9804	.9801	.9797	.9794	.9791	.9788

GROUP IV 64 TO 78.9 DEGREES A.P.I. AT 60°F

TEMP°F	0	1	2	3	4	5	6	7	8	9
0	1.0207	1.0204	1.0200	1.0197	1.0194	1.0190	1.0187	1.0183	1.0180	1.0177
10	1.0173	1.0170	1.0167	1.0163	1.0160	1.0156	1.0153	1.0149	1.0146	1.0142
20	1.0139	1.0136	1.0132	1.0129	1.0126	1.0122	1.0119	1.0115	1.0112	1.0108
30	1.0105	1.0101	1.0098	1.0095	1.0091	1.0088	1.0084	1.0081	1.0077	1.0074
40	1.0070	1.0067	1.0063	1.0060	1.0056	1.0053	1.0049	1.0046	1.0042	1.0038
50	1.0035	1.0031	1.0028	1.0024	1.0021	1.0017	1.0014	1.0010	1.0007	1.0003
60	1.0000	.9996	.9993	.9989	.9986	.9982	.9979	.9975	.9971	.9968
70	.9964	.9961	.9957	.9954	.9950	.9947	.9943	.9940	.9936	.9932
80	.9929	.9925	.9922	.9918	.9915	.9911	.9908	.9904	.9901	.9897
90	.9893	.9890	.9886	.9883	.9879	.9875	.9872	.9869	.9865	.9862
100	.9858	.9854	.9851	.9847	.9844	.9840	.9837	.9833	.9829	.9826
110	.9822	.9819	.9815	.9812	.9808	.9805	.9801	.9797	.9794	.9790
120	.9787	.9783	.9780	.9776	.9772	.9769	.9767	.9762	.9758	.9754

GROUP V 79 TO 88.9 DEGREES A.P.I. AT 60°F

TEMP°F	0	1	2	3	4	5	6	7	8	9
0	1.0235	1.0231	1.0227	1.0224	1.0220	1.0216	1.0212	1.0208	1.0205	1.0201
10	1.0197	1.0193	1.0189	1.0186	1.0182	1.0178	1.0174	1.0170	1.0166	1.0162
20	1.0158	1.0154	1.0150	1.0147	1.0143	1.0139	1.0135	1.0131	1.0127	1.0123
30	1.0119	1.0115	1.0111	1.0107	1.0103	1.0100	1.0096	1.0092	1.0088	1.0084
40	1.0080	1.0076	1.0072	1.0068	1.0064	1.0060	1.0056	1.0052	1.0048	1.0044
50	1.0040	1.0036	1.0032	1.0028	1.0024	1.0020	1.0016	1.0012	1.0008	1.0004
60	1.0000	.9996	.9992	.9988	.9984	.9980	.9976	.9972	.9967	.9963
70	.9959	.9955	.9951	.9947	.9943	.9939	.9935	.9931	.9927	.9923
80	.9919	.9915	.9911	.9907	.9903	.9898	.9894	.9890	.9886	.9882
90	.9878	.9874	.9870	.9867	.9862	.9857	.9853	.9849	.9845	.9841
100	.9837	.9833	.9829	.9825	.9821	.9817	.9813	.9809	.9805	.9801
110	.9796	.9793	.9789	.9785	.9781	.9777	.9772	.9768	.9765	.9761
120	.9756									

GROUP VI 89 & HIGHER DEGREES A.P.I. AT 60°F

TEMP°F	0	1	2	3	4	5	6	7	8	9
0	1.0247	1.0244	1.0239	1.0236	1.0231	1.0227	1.0223	1.0219	1.0215	1.0211
10	1.0207	1.0203	1.0199	1.0195	1.0191	1.0187	1.0183	1.0178	1.0174	1.0170
20	1.0166	1.0162	1.0158	1.0154	1.0150	1.0146	1.0142	1.0138	1.0134	1.0129
30	1.0125	1.0121	1.0117	1.0113	1.0109	1.0105	1.0101	1.0097	1.0093	1.0088
40	1.0084	1.0080	1.0076	1.0071	1.0067	1.0063	1.0059	1.0055	1.0050	1.0046
50	1.0042	1.0038	1.0033	1.0029	1.0025	1.0021	1.0017	1.0012	1.0008	1.0004
60	1.0000	.9996	.9992	.9987	.9983	.9979	.9974	.9970	.9966	.9962
70	.9957	.9953	.9949	.9945	.9940	.9936	.9932	.9928	.9923	.9919
80	.9915	.9910	.9906	.9902	.9897	.9893	.9889	.9884	.9880	.9876
90	.9872									

Table No. 6.

Arizona Utilities Assn. Elects Officers for 1931-'32

Arizona Utilities Association convened in annual session at the Biltmore Hotel, Phoenix, Ariz., April 9-11. The attendance totaled 158, with visiting delegates coming from California, New Mexico, Texas, Colorado and Utah.

The following officers were elected on April 11 to serve for the coming year:

President, Claude Webber, superintendent, gas department, Tucson Gas, Electric Light and Power Co., Tucson, Ariz.

C. H. Webber

First vice-president, C. T. Yates, assistant general manager, Arizona Edison Co., Phoenix, Ariz.

Second vice-president, F. L. Benham, manager, Upper Verde Public Utilities Co. Jerome, Ariz.

Directors: Willis T. Johnson, manager, Yuma Utilities Co., Yuma, Ariz; Geo. T. Herrington, manager, Flagstaff Electric Light Co., Flagstaff, Ariz.; L. V. Seares, vice-president and general manager, Arizona Power Co., Prescott, Ariz.; A. F. Morairty, assistant general manager, Central Arizona Light and Power Co., Phoenix, Ariz.

Executive secretary, J. S. Arnold, sales promotion manager, Central Arizona Light and Power Co., Phoenix, Ariz.

Tucson, Ariz., was chosen as the place of meeting for the next sessions of the association, in April, 1932.

Colorado Well Gauged At 34,000,000

The Mountain Fuel Supply Co., Ohio Oil Co. subsidiary, operating in Wyoming and Colorado, has opened a new gas structure in northern Moffat county, Colorado, with a well gauged at 34,000,000 cubic feet the first 24 hours.

Safety Work for Central Public Service

Ivan L. Scott has been named by Central Public Service Corp., Chicago, Ill., as head of the department of safety and insurance.

Applies for Newcastle Permit

Hugh Updike, Osage, Wyo., operator, has applied for a franchise to serve gas in the town of Newcastle, Wyo.

"Sales Wrinkle" Used by Council Bluffs Gas Co.

An opportunity to have their kitchens papered or painted for a nominal sum with the purchase of a new gas range was extended housewives of Council Bluffs, Iowa, by the Council Bluffs Gas Co. in a special range sale closing May 1.

The gas company arranged with two of the leading decorators in the city to do the work, and purchasers were allowed to name the color of the paint, or to choose the wall paper from a dozen patterns displayed.

Gas Consumption in Louisiana Shows Large Increase in 1930

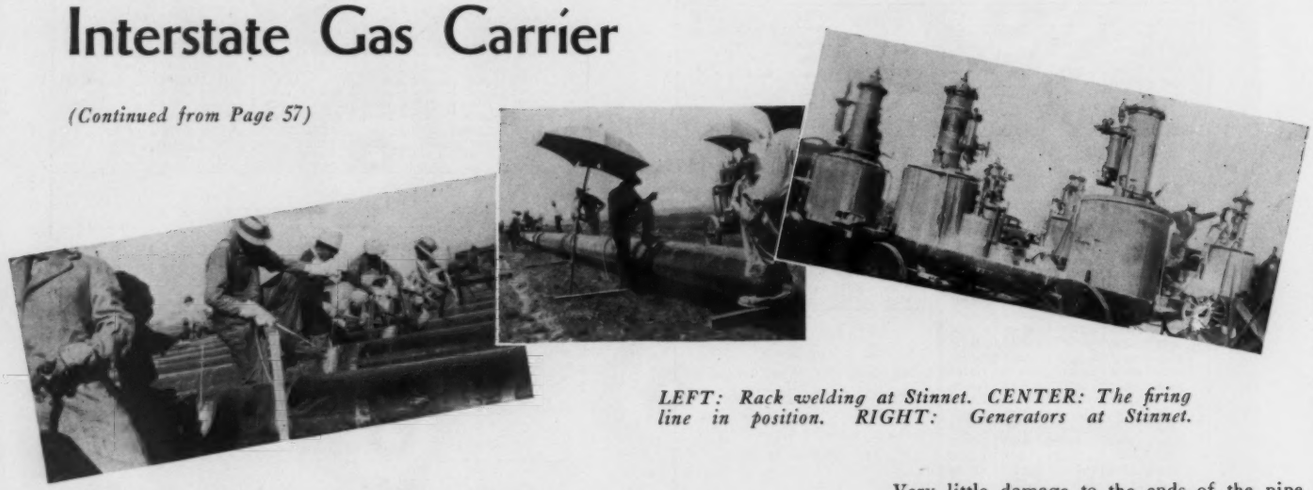
The state of Louisiana produced 277,104,400,000 cubic feet of gas during the year 1930, as compared with 262,680,000,000 cubic feet for the previous year, according to the annual report issued by the State Department of Conservation, issued in April.

Palmyra, Mo., Will Vote on Natural Gas Franchise

Central States Gas and Utilities Co., Kansas City, has applied to the town of Palmyra, Mo., for permission to serve natural gas there. The matter will come to a vote as soon as the terms of the franchise can be decided upon.

Construction of the Panhandle Eastern 1000-Mile Interstate Gas Carrier

(Continued from Page 57)



LEFT: Rack welding at Stinnet. CENTER: The firing line in position. RIGHT: Generators at Stinnet.

coating, and patching of the paint. He also made a record of the paint used, the temperatures at which it was applied, and the general condition of the pipe before painting. Each night the progress made during the day was reported to the pipe inspector by the other inspectors. The pipe inspector, in turn, reported a summary of this progress to the division inspection office, from which it was sent to the Kansas City office.

River crossing inspection was under the supervision of a special river crossing inspector, who had, as his assistants, a welding inspector and a paint inspector.

The material handling forces on the division cooperated closely with the division inspector in reporting shortages and ordering material for replacement, making proper disbursement, compiling material reports, and checking and assembling of unused material at the completion of the work. The survey parties on the division also cooperated with the division inspector as construction was in progress regarding relocating lines, setting progress stakes, details on river crossings, analyzing sub-soil and water conditions, and giving general advance information to the division inspector.

Right of Way: All brush, trees, stumps, boulders, and other obstructions were removed for a distance of 15 ft. on each side of the center line of the survey. Creeks, gulleys, and small hills were cut and smoothed to a width of 15 ft., to prepare a roadway for the ditching machine. The fences were cut and wire gates constructed so that the stringing trucks, ditching machine, paint wagons, etc., would have an opening in the fences during construction. Sand hills and small sharp rises in the earth, which entailed too much work for removal by hand, were trimmed down with Insley, clam-shell bucket tractors.

When crossing beneath railroads and main highways, the ditch was cut by hand a short distance on each side of the embankment, and then bored with a large 2-blade cutting auger, which was rotated by 4-inch pipe tongs and forced through by jacks. The cutting of these holes was speeded by forcing water into the hole ahead of the cutting edges of the auger. After the hole was completed, casing was shoved through, ready to receive the pipe.

Abrupt river banks were cut with long, gentle slopes, to be ready for the ditch. Marshes were corduroyed so that the trucks and machinery could cross. Where necessary fire lines were plowed about 20 feet on each side of, and parallel to, the center of the right of way.

Stringing: The first 22-in. pipe was received at Stinnett, Texas, on June 27, in a 20-car shipment, each car containing approximately 800 ft. The pipe was laid in gondola cars in tiers 7 ft. high, with boards between the tiers. Hardwood posts 4-in. x 4-in. x 8 ft. long, placed upright on the sides of the car with a ¾-inch wire tied from side to side, prevented the pipe extending above the sides of the gondola from rolling off. Very little damage to the ends of the pipe, due to slipping endwise, was noted. As the pipe arrived at the station it was unloaded with International 5-ton trucks equipped with 20-ft. end boom and cables with hooks which fitted into the ends of the pipe.

Extreme care was used in handling the pipe to prevent damage to the ends. It was stacked in tiers, with a 4-in x 4-in. x 8-ft. car post between each tier.

The pipe was hauled to the location of the line and unloaded with the boom tractor. It was placed on the ground end to end, ready to be coupled or welded together. Main line gate valves complete with fittings such as Van Stone nipples, two long sleeve couplings, three 6-in. by-pass valves, and by-pass connections were strung along the line at selected 8-mile intervals.

Ditching: Ditch was cut by rotary bucket machines. Two machines were used with each construction crew, and placed a mile apart. The back machine ditched until it connected with the ditch cut by the front machine, then moved ahead one mile. At no time during the construction of this division was there more than one mile of open ditch.

Ditch for the 22-in. main line was 42-in. deep and 36-in. wide. The ditch for the 24-in. main line was 52-in. deep and 38-in. wide. The ditch was graded by hand for overbends, padded for sags, and recessed for each coupling so that all the pipe would rest on the bottom of the ditch.

Welding: On the 22-in. main line from a point near Oil City, Texas, to Liberal, Kan., part of the welding was done in a welding

Cutting canal for 22-inch main line near Station 3400+00.

Pouring bitumastic on couplings—24-inch line.

R. R. casing auger—something new for the contractor.

Operating primer spray on 22-inch main line in Oklahoma.

yard. The pipe, as stacked on the ground, was picked up by tractors and carried to leveling tables for line-up. Two joints of pipe were lined up ready for welding, and tack-welded in four places with ¼-in. spaces between ends of the pipe. The pipe was then ready for welding. Before welding was permitted, each welder was tried out on a scrap piece, and was required to make 6 linear inches of weld under the supervision of the welding inspector.

Eight large acetylene generators were manifolded along seven leveling tables, each manifold with a battery of oxygen tanks and gauges hooked to hose and welding torches. Four welders with two helpers to each welder worked on each leveling or welding table, the helpers rolling the pipe as the welder progressed around it. The welds were made not over 4 in. from the top of the pipe, and never on the top. Welding on cold days without wind-breakers was not permitted. The extra generator was so connected that it could be used when any of the other seven generators were empty, thereby saving delays in recharging generators.

When this rack-welding, as it was called, was completed, the pipe was loaded on trucks and hauled to the line.

Line-Welding: This portion of the line was constructed by laying a section of three welded joints of pipe connected by a coupling. Since, in the yard or rack-welding, only two joints of pipe were welded, one weld to a three-joint section had to be made on the line. After some 20 miles of rack-welding had been completed, and the pipe strung along the line, field-welding was started. Ten acetylene generators were assembled on wagons and pulled by teams. Each generator wagon carried oxygen tanks and hose sufficient for four welders. The pipe was lined up in three-joint sections on skids or rollers and tacked and welded. Solid welded sections of pipe were used under highways, railroads, and through swamps. In such instances the ends of the solid welded section were bull plugged and tested with compressed air and soap suds before being tied-in with the rest of the line. Long sleeve couplings were used on each end of these solid welded sections.

In case of solid welded construction, which was used on lines 18 in. and smaller in diameter, five-joint sections were welded on the ground along the ditch, lowered into the ditch, and tied-in with a bell hole weld. After the tie-in, this line was laid in the ditch with slack loops crotched out of the ditch for a distance of 200 ft. out of every 1000 ft. of line. These slack loops were then lowered in early in the morning and refilled.

Bending: Bends were made in the field to fit the contour of the bottom of the ditch or the horizontal angles in it. One method of making these bends was as follows:

A welded two-joint section of pipe was laid parallel to another two-joint welded section about 2 ft. apart on one end. At this point the two lengths of pipe were lashed together with a ¾-in. cable. A bending block approximately 5 ft. long was placed between the two sections of pipe at the point at which the bend was to be made. The point selected was as far as possible from the weld. The layout now had the shape of a letter "A". The wide ends of the legs of the "A" thus formed were fastened together with a cable and snatch block, to one end of which was attached a tractor or winch. A kerosene heating torch was then placed on the outside of the pipe to be bent. The ends of this pipe were closed with a tin shield. The heat was then applied, and as the heating progressed, strain was taken on the cable by the tractor, until the desired degree of bend was secured. The torches were then removed, and strain held on the pipe until the bend had cooled.

Making drips at Morse, Texas

Class "C" drip near Station 3300 in Oklahoma.

Painting: The pipe was wiped clean with a burlap, then rolled on skids, and the primer coat on the top side applied with brushes. A second paint gang, turning the pipe 24 hours later, applied the primer to the pipe which was untouched by the first operation. Another paint gang applied the hot finish coat. A tractor lifted the pipe from the skids onto pipe rollers. The pipe was turned in the rollers by hand, and the hot paint applied to the rolling pipe with sprinkler cans with spreading nozzles or by asbestos pads, smoothing and spreading to even thickness as the pipe rotated. The paint was set soon after this painting operation was completed. The rollers and skids were removed, and the pipe allowed to lie on the ground. The paint pots were fired by distillate under pressure, and had a capacity of four 600 lb. drums of paint. The temperature of the hot paint was determined by thermometers at each hot pot.

During cold weather softening flux was added in sufficient quantities to prevent cold weather cracking. On damp days the pipe was wiped dry before application of hot paint, and on frosty mornings the frost was drawn out of the pipe by heating with kerosene torches. The ends of the pipe were left

Gate valve three miles east of Mullinville, Kansas

Pulling creek crossing into place, Palo Dura Creek.

Lowering in on 24-inch main line, using five tractors.

Laying from barge—Missouri River crossing.

Ditching on the No. 2 river line—16-inch Hugoton line at the Cimarron River crossing.

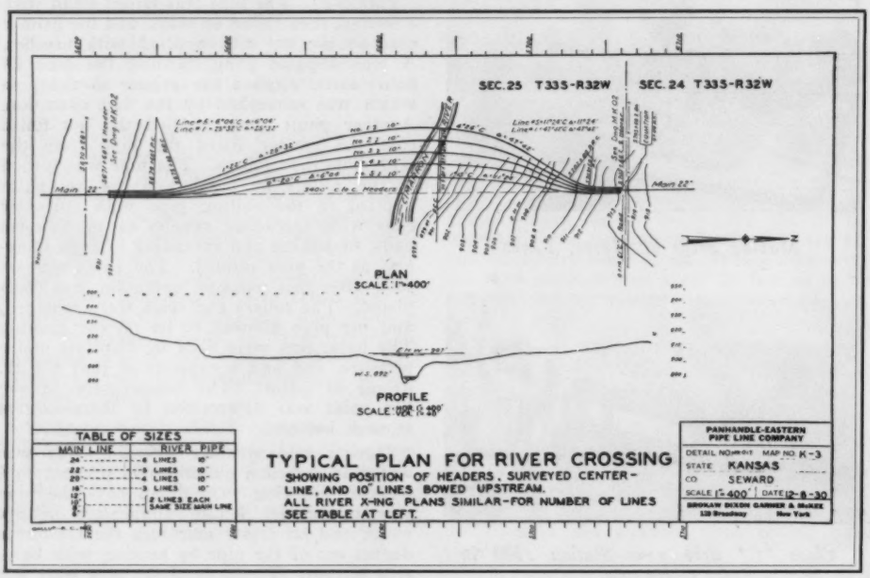


Diagram giving river crossing detail.

unpainted for a length of 8 in. from each end.

After the line was coupled together, a crew consisting of eight men—two using a canvas, two placing a flat pan under the coupling to catch the waste paint, and two pouring from sprinkling cans while the canvas men worked the hot paint in the bottom of the coupling—painted the couplings. The other two men of this crew patched spots on the coupling, using brushes.

Laying: A crew of ten men and one truck placed 6-in. x 6-in. x 8-ft. skids across the completed ditch, rolled the pipe within machine handling distance, placed followers on the ends of the pipe, re-wiped the unpainted ends of the pipe, and ran a steel swab, edged with canvas, through the pipe. This crew was called the line-up gang.

The laying gang consisted of 15 men, one pipe hustling machine, and one pipe stabber. The machine picked up a section of the pipe with a canvas belt, carried it to the line, and laid it on skids, where rubbers were placed on each end of the pipe, and the center ring on the end to be coupled. Any dirt picked up in the ends of the pipe in this handling was cleaned out. The machine picked up the single section, which was guided by the stabber until the machine sent the section home in the center ring. The followers were pushed up and the bolts inserted. Four bolts were inserted and made tight. The machine then slacked the line to the skids and moved forward to pick up another section. Two men inserted the 10 other bolts in each coupling, and tightened them with rachet wrenches, one man tightening on a bolt opposite from the wrench man on the other side. This bolting-up crew consisted of from 10 to 18 men, with two wrench men to test the bolts for tightness.

Couplings were now ready to receive a coat of hot coupling paint, the application of which has been described above. After the couplings were painted, four tractors picked up the line so that the skids could be removed. Canvas belts or slings were used around the pipe. The back tractor lowered until the one just ahead of it took the load, and then moved ahead, each tractor lowering its slack so there would be less than 1½° angle at each coupling. The line was now ready for backfill.

Before the backfill was completed, the main line gate valves, drips, syphons, and taps were installed. The Von Stone nipples were bolted on each side of the gate valve, and one full joint of pipe welded to each Von Stone nipple. The gate section thus formed was lowered in, and a long sleeve coupling placed on each end of the welded pipe. This gate valve assembly was not backfilled until a final test of the line was made. Ladder type drips were placed at each sag in the line. These drips were constructed as follows:

A piece of 10-in. pipe 12 in. long was welded to the bottom of the main line. About 12 ft. ahead of this another piece of 10-in. pipe 16 in. long was welded to the bottom of the main line. The lower ends of these 10-in. pipes were then welded into a full joint of 16-in. pipe, the ends of which were closed by an orange peel type of weld. This 16 in. welded receiving tank had a 3-in. blow-off connection welded to the bottom of the lowest end for draining liquid from it. The blow-off was operated by an extension velve wheel, and was swedged to 2 in., with a 1-in. plug valve at the top of the blow-off.

Blind taps 4-in. in diameter were welded at selected points for the future use in supplying gas to towns. One-inch blind taps were welded on the top of the main line, to be used in supplying farms along route.

Backfill: The refilling was performed by a Buckeye refill machine, which pulled the dirt into the ditch and dressed it up to a crown over the ditch. The location of taps was marked with 4-in. x 4-in. x 8-ft. skids set up-right in the ditch. Later the location of these farm taps was noted by the engineers for the final operating strip maps.

Behind the refill machine a fence repair gang with a truck repaired the fences and gates, and picked up paint cans, and other debris along the line.

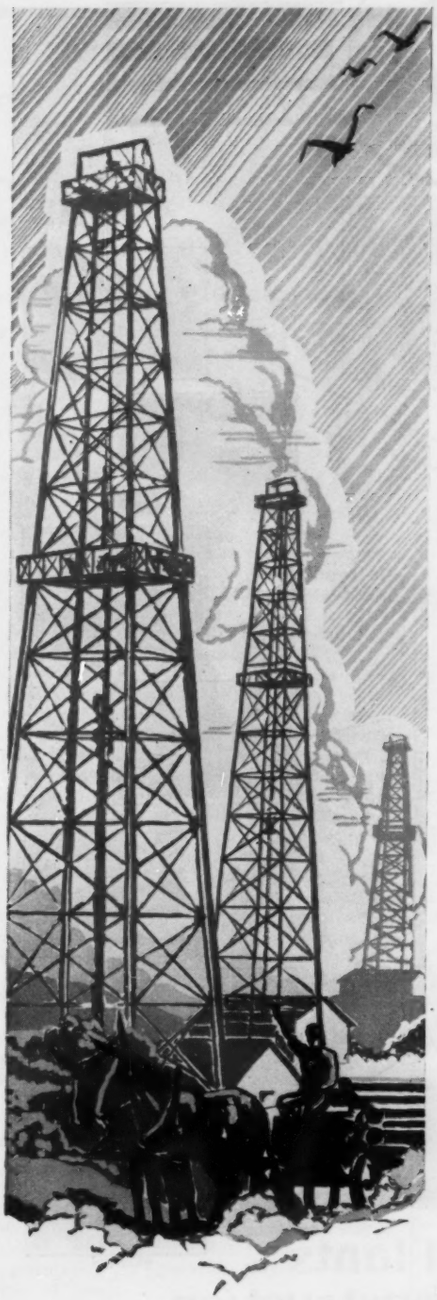
River Crossings

The main line crosses 15 principal streams. They are, in order from west to east: Canadian, Beaver, Cimarron, Arkansas, Neosho, Osage, Lamine, Missouri, Mississippi, and Illinois rivers; Brush Creek, Horse Creek, Sangamon River, Wabash River, and Big Raccoon Creek. Of these streams the Missouri, Mississippi, Illinois, and Wabash are navigable.

The main line stops on each side of the river at a point above high water mark. Where the main line is connected to the header or manifold there are three, four, five or six 10-in. outlets, depending on the size

(Continued on Page 82)

Memphis
ACHIEVEMENT



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SALES AND ENGINEERING SERVICE
IN PRINCIPAL CITIES

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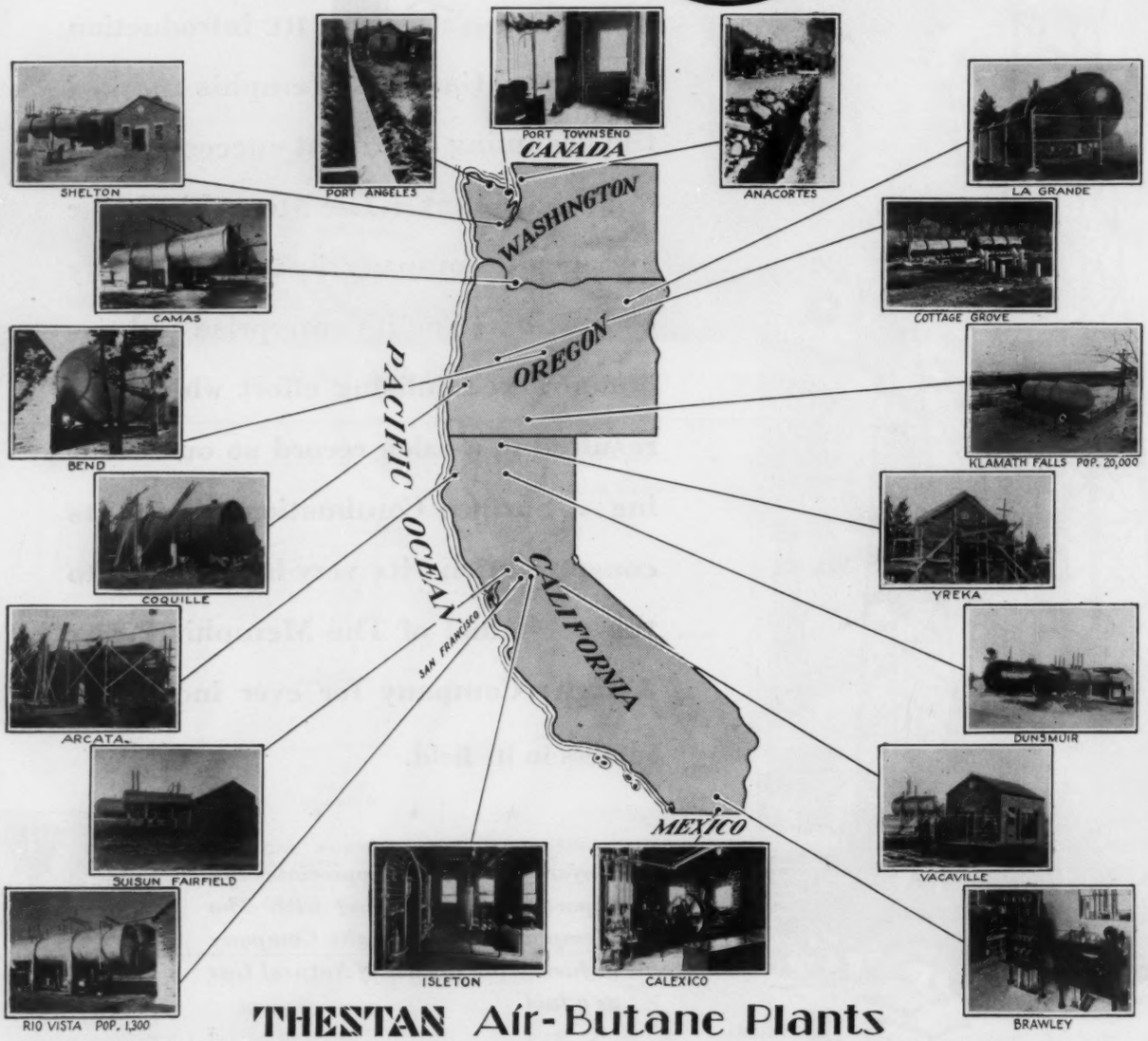

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BUTANE - PROPANE NEWS

Covering Liquefied Petroleum Gas Service

The Town Plant Outlook

Reporting a "Western Gas" Survey of Central Plants

FROM very recent beginnings the distribution of liquefied petroleum gas through central plants has already begun to assume the status of a national industry. Just three years ago, in 1928, the first butane-air plant went into experimental operation in Linton, Indiana. Gradually, as the possibilities of the new service became appreciated, different sections have fallen in line, until at the present time more than half the States are represented with one or more towns in the rapidly lengthening list of butane-propane communities.

Believing that the many individuals and companies now concerned with central plant service would welcome a survey of central plants, as a record of the industry's present status and its basis for current expansion, *Western Gas* is presenting the tabulation found in this issue of "Butane-Propane News." Arrayed in these tables are the names of operating companies, towns served (with populations and date of service), information on type of product distributed, and type of distribution system. Another significant item given is the one concerning merchandising activities of many companies listed—for butane-propane properties are due to become a real factor in appliance sales.

Through the cordial cooperation of the companies which comprise the industry, *Western Gas* is enabled to piece together a rather comprehensive picture of central plant service, which the reader may scan for himself in the accompanying tables. A few generalizations from the survey, however, are of particular interest.

SURVEY HIGHLIGHTS

Covered in the survey are some 123 communities. These run in size from less than 100 population to upwards of 10,000 in a number of cases.

These towns are served (or will be served) through 122 separate plants, operated by 59 companies.

Twenty-seven states appear in the tabulation, with practically every major territorial section of the country represented.

Total population of the towns now receiving butane-propane service (or soon to receive it through plants now building), approximates 600,000, as shown in the present tabulation. While this figure is only a fraction of the potential field eligible to this form of gas service, it may be regarded as

SURVEY OF CENTRAL PLANT INSTALLATIONS

Town	Population	Date Service Began (or will Begin)	Type of Service	Type of Distribution System	Does Company Sell Appliances?
ARIZONA					
Southwest Gas Corp., Ltd.			Undiluted Propane		
Winslow	3,917	1931	and Butane		
CALIFORNIA					
Natural Gas Corporation of California			Butane-Air	High Pressure	Yes
Arcata	1,709	June, 1931			
Brawley	10,439	October, 1930			
Calexico	6,229	October, 1930			
Dunsmuir	2,610	March, 1931			
Fairfield	1,131	November, 1930			
Isleton	2,090	December, 1930			
Rio Vista	1,309	December, 1930			
Suisun	905	November, 1930			
Vacaville	1,556	October, 1930			
Yreka	2,126	March, 1931			
Santa Maria Gas Co.			Undiluted Butane	Low Pressure	Yes
Buellton	90	May, 1931			
Morro Bay	900	July, 1930			
Solvang	425	January, 1931			
Southern California Gas Co.			Undiluted Propane	Low Pressure	Yes
Lancaster	1,200	November, 1930	and Butane		
Palmdale	342	December, 1930			
Mojave	564	December, 1930			
Southern Counties Gas Co.			Undiluted Propane	Low Pressure	Yes
Moorpark	450	1930	and Butane		
Los Flores Canyon	100	1930			
La Habra Heights		1930			
Southwest Gas Corp., Ltd.			Undiluted Propane	1½ lbs.	Yes
Barstow	2,700	April, 1931	and Butane		
Victorville	2,000	April, 1931			
COLORADO					
Trinidad Electric Transmission Railway and Gas Co.			Butane-Air		Yes
Trinidad	11,732				
GEORGIA					
Georgia Gas Co.			Butane-Air	Medium (5 lb.)	Yes
Gainesville	10,500	December, 1930			
ILLINOIS					
Great Northern Utilities Co.			Butane-Air		
Watseka	3,144	Under Construction			
Southwestern Illinois Gas Co.			Butane-Air	Medium (5 lbs.)	Yes
Eldorado	4,483	October, 1930			
Harrisburg	11,601	July, 1930			
Metropolis	5,570	December, 1930			
Vandalia	4,341	November, 1931			
INDIANA					
Linton Gas Co.			Butane-Air		
Linton	5,085				
Northern Indiana Power Co.			Butane-Air		
North Manchester	2,765				
Sheridan Gas Co.			Butane-Air		
Sheridan	1,763				
IOWA					
Central West Public Service Corp.			Butane-Air		
Sheldon		1930			
Central States Electric Co.			Butane-Air	High Pressure	Yes
Clarinda	5,000	April, 1930			
Missouri Valley	5,000	September, 1930			
Mapleton Gas Co.			Butane-Air		
Mapleton	1,622	1930			
Iowa Public Service Co.					
Ida Grove	2,206	To build soon			
Iowa-Nebraska Light & Power Co.			Butane-Air		
Shenandoah	6,502				

Town	Population	Date Service Began (or will Begin)	Type of Service	Type of Distribution System	Does Company Sell Appliances?
IOWA (Continued)					
Iowa Railway & Light Corp.			Butane-Air		
Mount Vernon	1,441	1930			
Skelly Oil Co.			Butane-Air	Combination	Yes
Animosa	3,579	Summer, 1931			
Audubon	2,255	Summer, 1931			
Cresco	3,069	Summer, 1931			
De Witt	2,041	Summer, 1931			
Dyersville	2,046	Summer, 1931			
Jefferson	3,431	Summer, 1931			
Manchester	3,413	Summer, 1931			
Marengo	2,112	Summer, 1931			
Monticello	2,259	Summer, 1931			
New Hampton	2,458	Summer, 1931			
Osage	2,964	Summer, 1931			
Spencer	5,019	November, 1930			
Tama	2,626	Summer, 1931			
Tipton	2,145	Summer, 1931			
Waukon	2,526	Summer, 1931			
KANSAS					
Western Gas & Utilities Co.			Butane-Air		
Goodland	3,626				
LOUISIANA					
Eunice Gas Co.			Butane-Air	Combination	No
Eunice	3,000	October, 1930			
MAINE					
Citzens Gas Co			Butane-Air		
Calais	5,470	January, 1930			
Central Main Power Co.			Butane-Air	High Pressure	Yes
Bath	9,110	1930			
Brunswick	6,144	1931			
MARYLAND					
The Eastern Shore Gas Co.			Butane-Air	High Pressure	Yes
*Berlin	2,500	September, 1931			
*Ocean City (Winter)	3,500	August, 1931			
*Ocean City (Summer)	50,000				
Pocomoke City	3,000	June, 1931			
MASSACHUSETTS					
Simonds Saw & Steel Co.			Butane-Vapor		
Fitchburg	40,692	Under construction			
Buzzards Bay Gas Co.			Butane-Air	Low Pressure	
Wareham	5,686	November, 1930			
Falmouth	4,821	Construction planned			
MINNESOTA					
Northland Utilities Co.			Butane-Air	2-3 lbs.	Yes
Chisholm	7,000	August, 1930			
Cloquet	6,000	June, 1931			
Ely	6,000				
Eveleth	7,000	November, 1930			
Grand Rapids	4,000				
Two Harbors	6,000				
North American Utilities Co.			Butane-Air	Medium (5 lb.)	Yes
Hastings	5,072	November, 1930			
Skelly Oil Co.			Butane-Air	Combination	Yes
Anoka	4,851	Summer, 1931			
Hutchinson	3,406	Summer, 1931			
Montevideo		Summer, 1931			
St. Peter	4,811	Summer, 1931			
Thief River Falls	4,268	Summer, 1931			
Municipalities Gas Corp.			Undiluted Propane in mains	2½ lbs. main pressure	Yes
Detroit Lakes	3,800	June, 1931			
Minnesota Public Utilities Co.			Butane-Air		
Bemidji	7,202	1930			
MISSOURI					
Maryville Electric Light & Power Co.			Butane-Air		
Maryville	5,217				
Missouri Public Service Co.			Butane-Air	Low Pressure	Yes
Clinton	5,744	July, 1930			
NEBRASKA					
Chadron Gas Co.			Butane-Air	3 bls.	Yes
Chadron	4,700	July, 1930			
NEW JERSEY					
Jersey Central Power & Light Co.			Butane-Air	Low Pressure	Yes
Beach Haven	715	May, 1931			

*Served from same plant.

a healthy beginning for an industry which struck its stride of growth a comparatively few months ago.

A considerable range in type of service is revealed in the table, which shows plants installed to serve butane-air, undiluted butane, undiluted propane, and undiluted propane and butane—the great majority being of the butane-air type.

Other information conveyed in the survey concerns the various types of distribution systems in use with central plant service. Some companies have adapted their systems to low pressures, others to high pressures, and others still to a combination of the two.

Many of the operating companies have provided interesting facts on their rate structure, in connection with *Western Gas'* survey. While this information is not tabulated in the accompanying forms, it will be the basis for an article in the "Butane-Propane News" department of a future issue. Under the head of rate structure some companies are billing on a pound basis, for service of undiluted propane or butane, or a combination of the two; some companies have set up their rates on a therm standard; the majority adhere to cubic feet rates. Practically all schedules returned are on a graduated block basis, and classification into domestic, commercial, heating, or other types of usage is provided in many instances.

The present survey is not only extremely interesting as a record of the companies which are taking leadership in butane-propane service through central plants; it has also brought to light many concrete plans for immediate expansion of territory served. Typical of such programs are the following:

Municipalities Gas Corp., through its subsidiaries Wahpeton Gas Co. and Detroit Lakes Gas Co., has an undiluted propane plant operating at Wahpeton, N. D., and another building at Detroit Lakes, Minn. The company now proposes to take propane service to territory within a 25-mile radius of these towns, building small distributing systems in outlying communities and trucking propane from its central plants. This type of expansion is a guide-post for future development.

Northland Utilities Co., operating in Minnesota, has embarked upon a four-year program looking to installation of 20 plants, with propane service for outlying districts.

The Eastern Shore Gas Co., now serving several communities in Maryland, reports that it is expecting "to supply all towns in Worchester and Somerset counties, Maryland, and towns in Virginia."

Summer of 1931 will be a busy period for town plant construction, as indicated in the tabulation of towns soon to be served. Skelly Oil Co., for example, intends to build 21 plants and distribution systems, in Iowa, Minnesota, and South Dakota during the summer months. Most of the states are represented in the list of plants contemplated for early building. There is much evidence of activity due for states which to date have few or no plants, but the present survey has been confined to developments which are in a definite stage of progress.

Franchising activity is continuing without interruption, a number of ambitious programs being under way. New England, Southern seaboard states, Arizona, and several Mid-Continent states are among those where current franchising activity is keenest.

All of the Utilities Gas & Electric Co. subsidiary operating units (in North and South Carolina, Wisconsin, Georgia, Minnesota, Tennessee, Illinois) report that they "expect to build in other cities in adjacent territory." This is typical of several organizations—the Natural Gas Corporations of

(Continued on Page 80)

Shipping Propane-Butane In Tank Trucks

By FRANK S. BURT

Test Engineer, Gas Department, General Petroleum Corp. of California

Fig. 1. Tank trailer designed by General Petroleum Corp. of California.

Fig. 2. Unloading from tank truck (in background) at Lancaster plant of Southern California Gas Co.

ONE of the most important factors governing service of liquefied petroleum gases through central distribution plants is that of transportation, the requirements to be met in design of transportation equipment varying with the particular product to be transported.

In the vapor-air mixed plant, a product consisting principally of butane and heavier fractions is used, and since this product requires very little pressure to maintain its liquid form, it may be shipped in light pressure tanks.

In the straight vapor system a product containing a large quantity of propane and no heavier fraction than a small percentage of normal butane must be used in order that natural vaporization may be effected at normal temperatures. The tanks used for the transportation and storage of this volatile mixture must be designed for working pressures above the maximum vapor pressure of the mixture at temperatures encountered during the hot summer period. Tank cars of the type 105A300 or 105A400 are used almost exclusively to transport these products over long distances. However, when the haul is short, it has been found more convenient and economical to use specially built tank trucks. Design and use of this type of equipment is covered briefly in the following paragraphs.

The first use of a tank trailer for the transportation of a liquid propane-butane mixture, as far as the writer knows, was by the Southern Counties Gas Co., Los Angeles, for hauling such a product to its straight vapor distributing plant at Moorpark, Calif.

The tank trailer as used by that company has a capacity of 1,500 gallons of liquid and is mounted on a four-wheel trailer chassis. The empty weight of this tank trailer is 9,410 pounds, and when loaded with a propane-butane product the gross weight approximates 16,000 pounds. This is less than half the allowable road weight limit which is 34,000 pounds.

The method of determining the liquid level in the tank trailer is by means of a small bronze vertical tube, with the bottom end open, which reaches to the bottom of the tank. This tube has a needle valve on the top and slides up and down through a packing gland in the top of the tank shell. When the needle valve is open, either gas or liquid will flow, depending on whether or not the tube extends into the liquid.

The General Petroleum Corporation of California designed and built a tank trailer (Fig. 1) last fall with the object in view of hauling a maximum quantity of propane-butane in one piece of equipment. This tank trailer, when empty, weighs 19,600 pounds, and allowing 8 per cent outage for vapor space the capacity for propane-butane mixtures is 3,039 gallons. Since the product weighs approximately 4.65 pounds per gallon, the pay load is 14,131 pounds, which makes the gross weight of the loaded trailer 33,731 pounds, or 269 pounds below the allowable limit.

This tank has a working pressure of 125 pounds per square inch and has two 1½-inch valves set at 125 pounds per square inch, a 2-inch valve for vapor flow, and a pressure gauge attached to the top of the dome, all of which are protected by a cylindrical sheet iron guard. A detachable gauge glass is used to determine the liquid level within the tank, there being four ½-inch connections for this purpose on the front end of the tank.

Loading and unloading of the liquid propane-butane is done through a 2-inch line at the bottom, and with connections so located that the truck may be loaded from either side. In addition to the outer valves, there is an internal emergency valve operated by a lever attachment on top of the tank. This valve is open only when loading and unloading, and may be closed quickly by pulling a wire cord from the rear of the tank which releases the trip that holds the valve open. A ¾-inch thermometer well extends from the top to near the bottom of the tank and three instruments for recording the tank pressure as well as liquid and atmospheric temperatures are housed in a special sheet iron box on the side of the truck.

A 2-inch by 15-foot metallic canvas covered hose used for liquid, and another similar type of hose ¾-inch by 20 feet for the vapor, are carried on the trailer in tubes built for that purpose.

The procedure used in loading the product is to allow it to flow into the tank truck under a pressure sufficient to prevent vaporization. This is accomplished by a back pressure regulator in the vapor line. As the liquid fills the tank the displaced vapor flows into the gasoline plant fuel system. When the loading is finished a sample of the liquid is taken for analysis in order to insure the shipment being up to specifications.

Unloading is by gravity flow of the liquid from the tank trailer into the gas plant storage tanks, which are lower than the street level. (Fig. 2.) A vapor equalizing line connecting both tanks allows the liquid to flow, and under this condition, as the liquid fills the plant storage tank, the displaced vapor flows to the tank trailer through the vapor line. This is of considerable importance since this vapor flow is equivalent to 25 or more gallons of liquid, depending on the pressure existing in the system.

Settlement for deliveries is based on either weight or liquid volume. The former is most generally used in tank car shipments, but a very satisfactory method is to gauge the liquid in the gas plant storage tank and correct the volume to 60°F. This is done by establishing factors for volumetric expansion or contraction based on the density of the liquid when the observed liquid temperature is above or below 60°F.

COST OF TRANSPORTATION

The cost of transportation by tank truck necessarily depends on the pay load. For instance, a truck and trailer equipped with pressure tanks naturally increases the tare weight of the load and limits the quantity

ONLY ONE WAY TO
ONLY ONE SURE

Because of the automatic operation made possible by the Calorimixer and C-H Control Board an attendant visits this butane gas plant of the Central Wisconsin Gas Co., Waupaca, Wis., only once a day.

The C-H Signal System safeguards the plant and flashes a warning if irregularities in the operation arise.

C-H

MIX BUTANE » » » » » » »
THAT'S ON THE B. T. U. BASIS
WAY TO DO IT » » » » » » »
the C-H CALORIMIXER

THE B.t.u. basis for mixing Butane Gas is most satisfactory. First, because the gas is used exclusively for heating and cooking purposes and is judged by the final consumer (and by law) on the heating value per cubic foot. Second, most of the physical properties of the gas which vary as a function of heating value do so to a less degree than the change in heating value. Thus control of the mixture on a B.t.u. or heating value basis is more accurate and reliable.

Besides controlling the mixing of your gas on the B.t.u. basis, the Cutler-Hammer Calorimixer makes your plant completely and finally automatic. The C-H Calorimixer not only guards the mixing infallibly, faultlessly, it not only corrects the flow *instantly* to compensate for every variation of B.t.u. content, but it shuts down and starts up your plant according to demand, without supervision. It flashes a signal when things go wrong; it shuts down the plant in case of power failure.

It Is Completely Automatic!

The Calorimixer is compact, rugged, durable, adjustable to all needs for small or large plant. Every day it is being adopted by more plants intent to capitalize upon the full possibilities of Butane Gas by furnishing the customer with a satisfactory, reliable fuel. The new booklet, "*Butane Gas Plant Control*," will be sent on request. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus*, 1273 St. Paul Ave., Milwaukee, Wisconsin.

Send for New Booklet "Butane Gas Plant Control"

This new booklet gives a brief picture of the Butane Industry as a going business and shows the requirements of the successful Butane plant, supplementing this with pictures of arrangement of equipment. It demonstrates the necessity of having *adequate* mixing control, by means of charts pointing out the effect of temperature and gravity changes upon the satisfactoriness of your service. It shows how *modern* methods have taken the guesswork and unreliability out of control of the all-important heating value. It describes the *modern* C-H Calorimixer in detail, how *by measuring of heating value alone* it does away with many causes of dissatisfaction and unsuccessful service. It describes the quick response, the fully automatic operation of the Calorimixer and its control, its flexibility, its applicability to *all* Butane plants. The ground-plan layouts of typical Butane plants shown are valuable and interesting. Finally, a chart lists all information necessary to secure the proper C-H Butane Mixing Control System.

Partial List of Installations of C-H Calorimixer Units in Butane Plants

NATURAL GAS CORPORATION OF CALIFORNIA
Vacaville, Calif. — Calexico, Calif.
Suisun-Fairfield, Calif. — Dunsmuir, Calif.
Isleton, Calif. — Yreka, Calif.
Rio Vista, Calif. — Arcata, Calif.
Brawley, Calif. — Fortuna, Calif.

NATURAL GAS CORPORATION OF OREGON
Coquille, Ore. — Bend, Ore.
La Grande, Ore. — The Dalles, Ore.
Klamath Falls, Ore. — Cottage Grove, Ore.

NATURAL GAS CORPORATION OF WASHINGTON
Port Townsend, Wash. — Anacortes, Wash.
Camas, Wash. — Port Angeles, Wash.
Shelton, Wash.

TENNESSEE GAS COMPANY
Maryville, Tenn. — Union City, Tenn.
Columbia, Tenn. — Murfreesboro, Tenn.
Morristown, Tenn. — Shelbyville, Tenn.

SOUTHEASTERN ILLINOIS GAS CO.
Harrisburg, Ill. — Metropolis, Ill.
Eldorado, Ill.

SOUTHWESTERN WISCONSIN GAS COMPANY
Sparta, Wis. — Tomah, Wis.

CENTRAL WISCONSIN GAS CO.
Waupaca, Wis.

CAROLINA CENTRAL GAS CO.
Hendersonville, N. C.

NORTHSHORE GAS COMPANY
Ipswich, Mass.

PEOPLE'S LIGHT COMPANY
Davenport, Ia.

IOWA RAILWAY & LIGHT CORP'N
Mount Vernon, Ia.

CUTLER HAMMER
Automatic Gas Mixing Control System

A-4100

of propane-butane that may be hauled. Equipment may be built for a 5,500-gallon pay load under present road regulations, or 3,000 gallons on the trailer and 2,500 gallons on the tank truck. For new equipment, the investment amounts to approximately $6,000 and $10,000 respectivelv. The estimtaed cost of operating this equipment, including fixed charges, is $584 per month. For distances up to 150 miles, approximately 55,000 gallons can be hauled conveniently each month, which makes the cost of transportation about 1 cent per gallon. This is considerably cheaper than tank car shipments under present freight rates, which are in excess of 2 cents per gallon. Another advantage of the tank truck is that it may be used to expedite the transportation of other gasoline products.

The Economics of Butane-Air Gas Systems

By LEON J. WILLIEN

*Operating Gas Engineer, Byllesby Engineering and Management Corporation, Chicago, Illinois**

THE purpose of this paper is to estimate 1. The total investment requirements, 2. The total operating costs, and 3. The net earnings for serving butane-air gas to 300, 500, 750, 1000, and 1500 customers in small communities.

These estimates are based upon general average conditions and no doubt will have to be modified more or less to suit local conditions in order to determine the economics of serving butane-air gas in a particular community.

An attempt was made to obtain as much data as possible from the butane-air plants that have been installed. Some of these data were very helpful, especially the data on the plant cost, while other data were not. The data on the cost of the distribution system were very erratic because in some cases the distribution mains installed were capable of serving 500 or more customers whereas the actual number served was much less. The cost of the distribution system per customer was, therefore, abnormally high. The actual operating costs, especially the costs other than the cost of production, were abnormally high due to passing through the development period and the general poor business conditions.

The distribution system was estimated on the basis of 100 ft. of main per customer.

It was assumed that the Distribution, Commercial, New Business, and General Expenses would be the same for butane-air gas as for manufactured gas. Data were therefore obtained on the actual cost for these expenses from 64 gas companies in communities in which 2000 customers or less are served with manufactured gas. Data were also obtained from these same companies on:

1. Gas consumption per customer per year,
2. Gross revenue per customer per year,
3. Miles of actual distribution mains, and
4. Population of community served.

From this data curves were plotted showing the Distribution, Commercial, New Business, and General Expenses per customer per year of serving from 300 to 2000 customers.

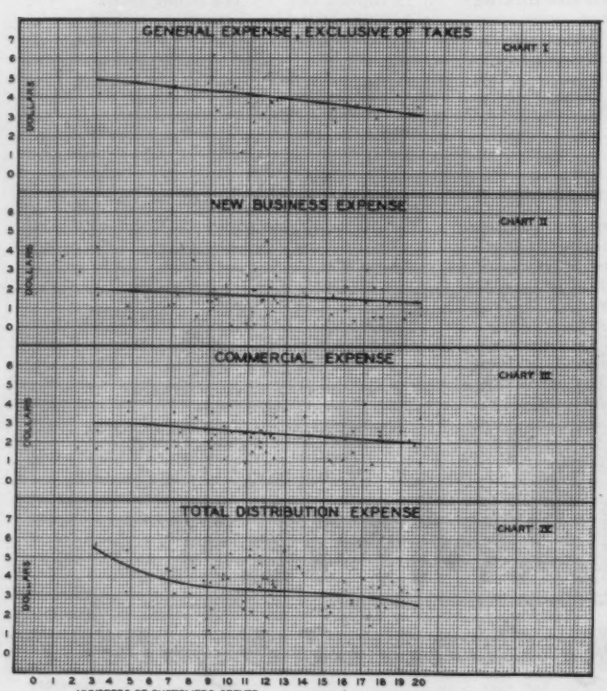

GENERAL EXPENSE, EXCLUSIVE OF TAXES
CHART I
NEW BUSINESS EXPENSE
CHART II
COMMERCIAL EXPENSE
CHART III
TOTAL DISTRIBUTION EXPENSE
CHART IV
DOLLARS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
HUNDREDS OF CUSTOMERS SERVED

FIG. 1.

Average expenses for serving manufactured gas in small communities —in dollars per customer per year.

Plant Capacity: The average yearly consumption of 79,667 customers in 64 communities in which 2000 or less customers are served with manufactured gas was 28,500 cu. ft. Assuming a 10 per cent loss in distribution, the average yearly sendout per customer will be 31,350 cu. ft., or 86 cu. ft. per customer per day. The average daily sendout will, therefore, be for:

300 customers	25,800 cubic feet.
500 customers	43,000 cubic feet.
750 customers	64,500 cubic feet.
1000 customers	86,000 cubic feet.
1500 customers	129,000 cubic feet.

The capacity of most of the butane-air gas plants installed is 120,000 cu. ft. per day. This is ample for 750 customers but should be more for 1000 and 1500 customers. The plant capacity for 1000 and 1500 customers is based on 280,000 cu. ft. per day.

Butane Storage Tanks: The butane requirements per M. of 540 B.t.u. gas were assumed to be as follows:

5.27 gal.
.05 gal. for vaporization

5.32 gal. per M of sendout

The average daily requirements, therefore, will be for:

300 customers	137 gal.
500 customers	229 gal.
750 customers	343 gal.
1000 customers	458 gal.
1500 customers	686 gal.

The minimum butane storage capacity should be 17,500 gallons. The tank cars used for shipping butane have a capacity of 10,000 gallons. A 17,500 gallon tank will, therefore, assure an adequate reserve to meet the requirements between the time a tank car is ordered and its arrival, when serving up to 750 customers. For 1000 and 1500 customers a 24,000-gallon tank should be installed. The estimates were made on that basis.

Gas Storage Tanks: The gas storage tanks were estimated on the basis of high pressure tanks having a capacity equal to 75 per cent of the average daily sendout at 50 lbs. pressure.

Gas Distribution System: The distribution system was estimated on the basis of a medium high pressure system to be operated at 2- to 5-lbs. pressure with individual house regulators. The system is to consist of 2 in. and and 4 in. pipes and to be all welded covered steel pipe. The services are to be ¾-in. steel pipe coated and welded to the main. All mains and services are to be buried 3 ft. underground and tested to 50 lbs. pressure. An assumed figure of 53 customers per mile of actual main was used. An average of 52 communities in which 2000 or less customers are served with manufactured gas showed 48.5 customers per mile of main. It was also assumed that the distribution system cost $97.00 per customer, consisting of the following items:

Mains, 100 ft. at 55c per ft.	$55.00
Service, 80 ft. at 30c per ft.	24.00
Regulator, installed	6.00
Meter, installed	12.00
Total cost per customer	$97.00

If properly installed the cost of a distribution system for serving butane-air gas should be very little, if any, less than for manufactured gas. It is claimed that no drips are required and that the mains do not have to be laid to grade for butane-air gas. I doubt the ability to operate without drips, but even

*Presented at A.G.A. Distribution Conference, Cincinnati, Ohio, April 8-10, 1931.

if it is possible to do so, it should not reduce the cost of the distribution system 20 per cent to 35 per cent.

Franchise: The cost of obtaining a franchise is estimated at $1000.

Working Capital: Working capital is a legitimate item to include in the Total Capital Investment. Most regulatory commissions permit an amount to be used for this item equal to two months' operating expenses.

Operating Expenses

Butane: The cost of butane is taken at 7c per gallon delivered. (4c at refinery plus 3c freight). The amount required per M. sold is based on delivering a 540 B.t.u. gas with a 10 per cent loss in distribution. The amount required per M. sold will, therefore, be:

5.27 gals. per M. made
.05 gals. per M. made for vaporizing
.53 gals. per M. for distribution losses

5.85 gals. per M. sold

The annual requirements are based on a consumption of 28,500 cu. ft. per customer per year.

Pumping and Mixing: This is based on 2¼ K.W.H. per M of sendout at 2c per K.W.H. It is assumed that all the gas is compressed to 50 lbs. pressure.

Plant Superintendence and Labor: This is taken at $600 per year for plants serving up to 750 customers, and $1000 for 1000 and 1500 customers.

Miscellaneous Supplies and Expenses: This is taken at $350 per year for plants serving up to 750 customers, and $500 for 1000 and 1500 customers.

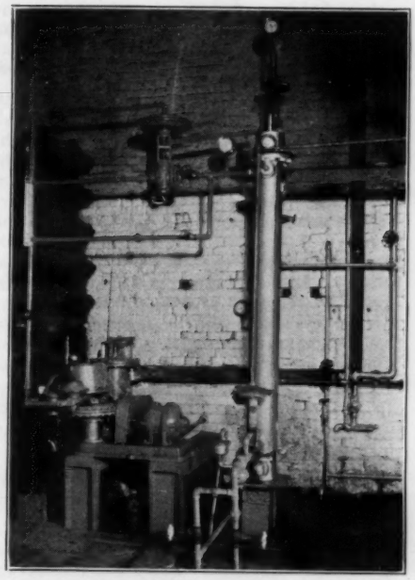
Production Maintenance: This is assumed at 2c per M. of sendout.

Distribution, Commercial, New Business, and General Expenses: It was previously explained that these expenses have probably been high for the butane-air plants installed. Since these expenses are really the cost of rendering service, they should be approximately the same for butane-air gas as for manufactured gas. Charts 1-4 show the per customer cost per year for these various items for serving from 300-2000 customers. These charts were prepared from actual cost of serving manufactured gas in 64 communities in which 2000 customers or less are served. The costs per customer per year used for these various items are as follows:

Customers	300	500	750	1000	1500
Distribution	$5.50	$4.40	$3.70	$3.40	$3.10
Commercial	3.00	3.00	2.80	2.60	2.30
New Business	2.00	1.90	1.80	1 70	1.55
General	4.90	4.70	4.40	4.10	3.65

Revenue from Gas Sales: This was taken at $44.00 per customer per year. It is the average gross revenue of 79,667 customers in 64 small communities in which 2000 or less customers are served with manufactured gas. The average consumption per customer was 28,500 cu. ft., giving an average revenue per M. sold of $1.61. This represents the revenue received for the gas sold for all purposes—domestic, commercial, and industrial. The gross revenue per customer per year is fairly constant regardless of the price per M. at which it is sold. The average revenue for 153 gas companies that reported to the Statistical Department of the American Gas Association for 1929 was $45.00 per customer with an average rate of $1.27 per M.

The revenue per customer per year in communities that are suburbs of a large city, may be higher than $44.00. It may be as



This Parsons-Kemp Butane Air-Gas plant supplies the town of Trinidad, Colorado, with a capacity of 108,000 cubic feet per 24 hours. The carburetion and vaporization equipment illustrated, occupies 60 square feet in a corner of one of the rooms of Trinidad's former coal gas plant.

Butane Pioneers

PARSONS-KEMP engineers and equipment are pioneers in the field of Butane dilution.

Today, Parsons-Kemp Butane-Air Gas Dilution equipment is at work in nearly two-score town gas plants from Maine to Oregon, supplying constant B.t.u. value in low, intermediate and high pressure systems, and meeting hourly requirements varying from 4,500 cubic feet to 30,000 cubic feet.

Sixty years of engineering and manufacturing experience in fully automatic gas-air proportioning devices are behind every Parsons-Kemp unit and every Parsons-Kemp installation. As a result of this extensive background and facilities unusual in such a comparative new field, Parsons-Kemp now offers three types of Butane dilution plant service:

1. Planning, supplying equipment for and building complete plant or plants.
2. Planning, supplying equipment, arranging all contracts for and supervising construction of complete plant or plants.
3. Supplying equipment for plant or plants.

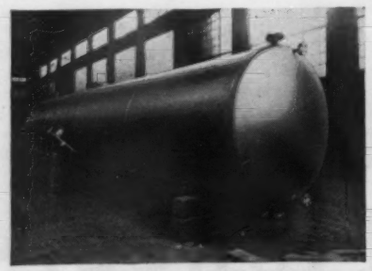
For complete information on Parsons-Kemp equipment, engineering services and operating data on present town gas plants, write:

PARSONS ENGINEERING COMPANY
525 Market Street **San Francisco**
affiliated with
The C. M. KEMP MFG. CO.

LEADERS IN AIR BUTANE DEVELOPMENT ON THE PACIFIC COAST

▼

NATURAL GAS CORPORATION OF CALIFORNIA
NATURAL GAS CORPORATION OF WASHINGTON
NATURAL GAS CORPORATION OF OREGON
San Francisco and Portland



WELDED BUTANE RECEIVERS

84" x 33' 9" receiver built by Biggs. Working pressure, 200 pounds. Weight—34,500 pounds.

Ten welded butane gas receivers like this one were furnished by Biggs and installed in December, 1929 and January, 1930. After a year's service the customer wrote:

"The tanks have been in practically continuous service, storing butane-propane mixtures and high test gasoline. The tanks were purchased for 200 pounds working pressure, but on one or two occasions have had pressures in excess of 225 pounds on them for short periods of time. The tanks are painted with aluminum paint and are uninsulated. To date we have experienced no difficulties with them, nor seen any evidence of leakage, seepage, strain or structural weakness of any description."

May we send you a pictorial folder "Unusual Steel Plate Construction"?

The Biggs Boiler Works Company
Akron, Ohio

BIGGS VESSELS
Welded or Riveted

Connelly Iron Sponge & Governor Company

GOVERNORS

Automatic Balance District
High or Low Pressure
Back Pressure Valves

Photometers Testers

Siphon Pressure Gauges
Telemetric Gauges

Street Dep't Requisites
Lookwood Safety Valves
Gas Works Equipment
Gas Screens
Gas Tape

Combination Valve

Caloroptic Calorimeter
Counter-Balance Man Hole
Safety-Syphon Seal

Write for Bulletins

ELIZABETH NEW YORK
CHICAGO

high as $55.00 or $60.00, or more than in the large city itself. In a small rural community a revenue of $44.00 per customer per year is about all that can be reasonably expected.

Revenue from Merchandising Sales: This I have taken to be the same as the New Business Expense. The first one or two years the revenue from Merchandising Sales will be greater than it will be after the business has been developed. In some estimates I have seen on serving butane-air gas in small communities, it was assumed that the profits on Merchandising Sales would pay the office expenses. The average gas company makes very little, if any, profits on Merchandising Sales. It is not fair to assume, therefore, that merchandising profits will pay the office expense.

Taxes and Depreciation: The taxes are estimated at 2½ per cent of an 80 per cent valuation, or 2 per cent of the total tangible investment exclusive of Working Capital.

Depreciation is estimated at 10 per cent on the plant equipment and 2½ per cent on the distribution system.

Estimated Costs of Serving Butane-Air Gas in Small Communities: Table No. 1 shows the estimated investment requirements, and Table No. 2 shows the operating costs, revenues, and net returns for serving butane-air gas to 300, 500, 750, 1000, and 1500 customers in small communities. As previously stated, these figures represent general average conditions and would probably have to be modified to suit local conditions in any particular community.

Customer Saturation: The data obtained from the 64 communities in which manufactured gas is served to 2000 or less customers, showed an average saturation of one gas customer for every 8.5 population, or 11.8 per cent.

When gas service is introduced in a small community it will probably require five years to reach the ultimate customer saturation point. About 50 per cent of the customers will be obtained by the end of the first year, 75 per cent by the end of the second year, and 100 per cent by the end of the fifth year.

Acknowledgments

Most of the data used in preparing this paper were submitted by the following companies:

Midland United Company
Central Public Service Corp.
American Light & Traction Co.
United Light & Power Co.
Federal Public Service Corp.
Standard Gas & Electric Co.
Utilities Gas & Electric Co.
Philfuels Co.

I wish to express my appreciation to these companies for the assistance rendered.

TABLE NO. 1—TOTAL CAPITAL INVESTMENT

Customers Served	300	500	750	1000	1500
Intangible					
Organization	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Franchise	1,000	1,000	1,000	1,000	1,000
Total intangible	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000
Tangible					
Plant cost					
Land and grading	$ 800	$ 800	$ 800	$ 1,200	$ 1,200
Railroad siding	1,100	1,100	1,100	1,100	1,100
Building	3,500	3,500	3,500	5,000	5,000
Butane storage tank	2,500	2,500	2,500	3,000	3,000
Gas storage tank	2,600	4,300	6,450	8,600	12,900
Vaporizing equipment	660	660	660	660	660
Carbureting equipment	1,560	1,560	1,560	3,120	3,120
Control equipment	1,320	1,320	1,320	1,320	1,320
Compressing equipment	1,140	1,140	1,140	2,280	2,280
Misc. lighting, piping, elec. and water service	3,600	3,600	3,600	5,000	5,000
Total Plant Cost	$18,780	$20,480	$ 22,630	$ 31,280	$ 35,580
Distribution system	$29,100	$48,500	$ 72,750	$ 97,000	$145,500
Office furniture and fixtures	600	600	600	1,000	1,000
Working capital	1,600	2,500	3,560	4,500	6,500
Total Tangible	$50,080	$72,080	$ 99,540	$133,780	$188,580
Total Capital Investment	$53,080	$75,080	$102,540	$136,780	$191,580

TABLE NO. 2—OPERATING EXPENSES, REVENUES, AND NET RETURNS PER YEAR BASIS

Customers Served	300	500	750	1000	1500
Butane	$ 3,500	$ 5,835	$ 8,750	$11,670	$17,500
Power	423	705	1,060	1,410	2,120
Supt. and labor	600	600	600	1,000	1,000
Misc. sup. and exp.	350	350	350	500	500
Prod. maint.	190	315	470	630	940
Total prod. and maint.	$ 5,063	$ 7,805	$11,230	$15,210	$22,060
Distribution expense	1,650	2,200	2,775	3,400	4,650
Commercial expense	900	1,500	2,100	2,600	3,450
New business expense	600	950	1,350	1,700	2,325
General and miscellaneous expense	1,470	2,350	3,300	4,100	5,475
Total operating expense	$ 9,683	$14,805	$20,755	$27,010	$37,960
Revenues from gas sales	$13,200	$22,000	$33,000	$44,000	$66,000
Revenues from merchandise sales	600	950	1,350	1,700	2,325
Total Revenue	$13,800	$22,950	$34,350	$45,700	$68,325
Net Operating Revenue	4,117	8,145	13,595	18,690	30,365
Taxes	$ 970	$ 1,392	$ 1,920	$ 2,585	$ 3,640
Depreciation	2,605	3,260	4,082	5,553	7,190
Total Taxes and Depreciation	$ 3,575	$ 4,652	$ 6,002	$ 8,138	$10,830
Net Revenue	542	3,493	7,593	10,552	19,535
Net Revenue on Capital Investment	1.0%	4.7%	7.4%	7.7%	10.2%

Butane-Air Plant at Trinidad

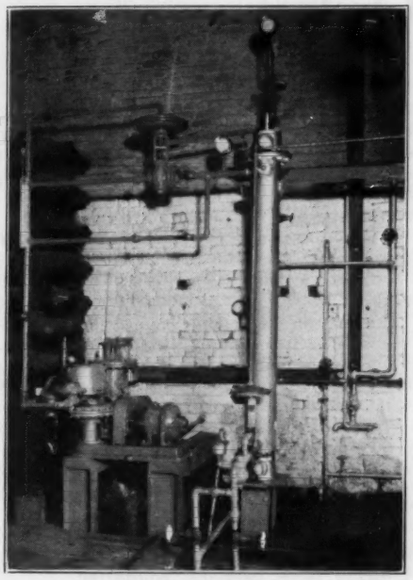


Fig. 1

By E. B. DUNKAK

President, Propane-Butane Contracting Corporation.

BUTANE as a base fuel for the small town gas plant has demonstrated, during the past three years, its remarkable flexibility in meeting the varying requirements of individual localities. Included in the four-score or more town gas plants now in operation in all parts of the United States are plants designed for almost all possible conditions. That these conditions have been satisfactorily met is best answered by the expansion programs now under way in all parts of the country.

It is a generally known fact that the first butane air gas dilution plant for town gas service was placed in operation at Linton, Indiana, in 1928, where it succeeded a small coal gas plant. The installation was an immediate success and is in a sense responsible for the present-day nation-wide interest.

There are many town gas plants with daily sendout of less than 150,000 cu. ft. where the overall cost of manufacture can be materially reduced by what is proportionately a very slight expenditure.

Simplicity of plant, dependability of operation, reduction in labor and improvement in quality of sendout, all favor this new liquid fuel. To cite but one of many examples—Trinidad Electric Transmission, Railway & Gas Co., Trinidad, Colo., had, until early this year, operated for many years a coal gas plant to supply 785 consumers. Send-out measured approximately 60,000 cu. ft. per day, approximately 470 B. t. b. per cubic foot. Because of years of operation, the two coal gas benches were scheduled to be torn down and rebuilt in the spring of 1931. W. S. Dole, gas engineer for the Federal Light & Traction Co., New York City, operators of the Trinidad Electric Transmission Railway & Gas Co., was familiar with the butane-air gas development and conceived the idea of erecting a butane-air plant for a temporary gas supply while the rebuilding operations were in progress, retaining the plant for a standby at the conclusion of this work.

Engineers of the Propane-Butane Contracting Corp. were consulted, and a contract covering the erection of a suitable butane plant was placed. Six weeks after the placing of this contract the butane-air gas plant was in operation.

The plant is interesting because its design has been thoroughly tried and has proven, over a period of time, to be amazingly dependable.

Fig. 1 shows all the equipment required, with the exception of butane storage tank and send-out holder installed in a portion of the existing coal gas plant. The total floor space occupied by this pressure regulation, vaporization and carburetion equipment is approximately 60 square feet.

The Parsons-Kemp industrial carburetor, designed for mixing two gases accurately in predetermined ratio, is used at the Trinidad plant for butane-air gas dilution. Without any manual attention, it automatically responds to variation in send-out demand, inducing the air for dilution from the surrounding atmosphere and delivering the finished gas at pressure up to 2 lbs. per square inch.

The unit at Trinidad Electric Transmission Railway & Gas Co. has a discharge capacity of 4500 cu. ft. per hour at a discharge pressure of 8 ounces. The finished gas on leaving the industrial carburetor flows directly into the lift type holder previously used with the coal gas plant.

The simplicity of the plant is reflected in its cost. Such a plant can be installed and placed in operation on an existing site for approximately $60 per 1000 cu. ft. of 24-hour send-out capacity.

The change-over from the one gas to the other can be effected speedily without affecting consumer relations. At Trinidad 12 hours after the butane plant piping was complete, the coal gas plant was shut down and the town was placed on butane-air gas. That consumer relations were unaffected is best witnessed by the fact that out of a total of 785 meters, there were but 38 service complaints.

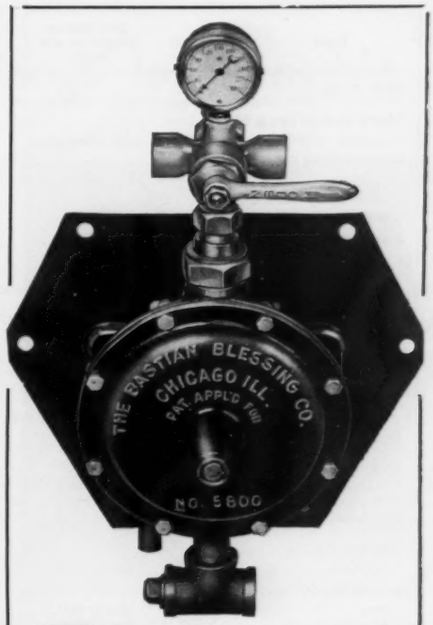
The Trinidad installation is but one of many which have clearly shown the possibility of the rehabilitation of what is, in many cases, an unprofitable gas property.

Device for Carrying "Bottled" Gas Cylinders on Autos

A device permitting customers to carry "Stargas" drums on their cars with safety and at a considerable saving has recently been put into use by the Lone Star Gas Co., Dallas, Texas.

Fiber straps are buckled around the drums which rest in steel braces bolted to the running board of the car. W. J. Garner, general foreman of the company's shops, invented the device and tested its service on 17 makes of automobiles before it was made available to the public. It is easily removable.

Customers who deliver their own drums to the distributing point for refilling are allowed a substantial discount on the cost of drum gas.



The *Original* Petroleum Gas Regulator

When the Liquefied Petroleum Gas industry was yet a pup, The Bastian-Blessing Company, sensing its possibilities, designed, engineered, fabricated and installed the original control equipment. Today's wide acceptance of these units proves that planned products have a definite place.

The Special Pressure Regulator illustrated is merely a refinement of the original, which we created for the then-beginning industry.

The Rego Pressure Regulator is fool-proof . . . it is easily and quickly installed . . . has a diaphragm and seat immune to gas-attacks . . . and controls pressures perfectly. Models available for "wet" or "dry" gas.

Separate Units — or a Complete Assembly of Manifold, Regulator, Seal, etc.

Factory-tested assemblies, packed in substantial re-shipping cartons, solve the problem of installing controls "out on the job." These assemblies comprise Manifold, all Cylinder Connections, Two-way throw-over valve, Regulator, Mercury Seal and a supply of mercury.

Vast data on merchandising and distribution available. Ask us any question.

The Bastian-Blessing Company
254 E. Ontario St.
Chicago, Ill.

Town	Population	Date Service Began (or will Begin)	Type of Service	Type of Distribution System	Does Company Sell Appliances?
NEW YORK					
Central Hudson Gas & Electric Corp.			Butane-Air		
Catskill	5,082	Under construction			
County Utilities Co.			Butane-Air		
Fallsburg		Plant contemplated			
Hudson Valley Gas Co.			Butane-Air	High Pressure	Yes
Walden	5,000	July, 1931			
New York Power & Light Co.			Butane-Air	2-5 lbs.	Yes
Canajoharie Palatine Bridge	3,500	July, 1931			
NORTH CAROLINA					
Carolina Central Gas Co.			Butane-Air	Medium (5 lb.)	Yes
Hendersonville	5,063	May. 1930			
Southern Public Utilities Co.			Butane-Air		
Mt. Airy	6,045				
NORTH DAKOTA					
Municipalities Gas Corp.			Undiluted Propane in mains	2½ lbs. main pressure	Yes
Wahpeton	3,500	Under construction			
OREGON					
Lakeview Gas Co.			Butane-Air	Low Pressure	Yes
Lakeview	2,000	March, 1931			
Natural Gas Corporation of Oregon			Butane-Air	High Pressure	Yes
Bend	8,848	March, 1931			
Coquille	2,732	May, 1931			
Cottage Grove	2,473	April, 1931			
Klamath Falls	16,093	January, 1931			
La Grande	8,050	January, 1931			
SOUTH CAROLINA					
Skelly Oil Co.			Butane-Air	Combination	Yes
Brookings		Summer, 1931			
Madison		Summer, 1931			
Georgia Public Service Corp.			Butane-Air	Low Pressure	Yes
Aiken	6,000	October, 1930			
South Carolina Gas Co.			Butane-Air	Medium (5 lb.)	Yes
Gaffney	6,879	December, 1930			
Southern Public Utilities Co.			Butane-Air		
Chester	5,528				
SOUTH DAKOTA					
Watertown Gas Co.			Butane-Air		
Watertown	928				
TENNESSEE					
Cleveland Gas Co.			Butane-Air		
Cleveland	9,136				
Tennessee Gas Co.			Butane-Air	Medium (5 lb.)	Yes
Columbia	8,787	August, 1930			
Maryville	4,910	July, 1930			
Morristown	7,310	September, 1930			
Murfreesboro	8,046	November, 1930			
Shelbyville	5,500	May, 1931			
Union City	5,865	October, 1930			
TEXAS					
Kerrville Gas Co.			Butane-Air	Combination	No
Kerrville	4,965	May, 1930			
VIRGINIA					
Consumers Utilities Co.			Butane-Air		
Harrisonburg	7,232				
Virginia Gas & Utilities Co.			Butane-Air		
Martinsville	7,705				
Pulaski	7,168				
Radford	6,227				
WASHINGTON					
Natural Gas Corp. of Washington			Butane-Air	High Pressure	Yes
Anacortes	3,091	April, 1931			
Camas	4,239	March, 1931			
Port Angeles	10,188	May, 1931			
Port Townsend	3,979	April, 1931			
Shelton	3,091	April, 1931			
WISCONSIN					
Central Wisconsin Gas Co.			Butane-Air	Medium (5 lbs.)	Yes
Waupaca	3,121	December, 1930			
Southwestern Wisconsin Gas Co.			Butane-Air	Medium (5 lb.)	Yes
Sparta	4,917	August, 1930			
Tomah	3,343	October, 1930			
Wisconsin Power & Light Co.			Butane-Air		
Markesan	872	1930			

The Town Plant Outlook

(Continued from Page 72)

California, Oregon, Washington; the Skelly Oil Co.; and others—which have entered the butane-propane field with definitely formulated plans for rounding out extensive systems.

These mentioned expansion programs are only typical of numerous others—giving assurance of a remarkable outreach for butane-propane service in the immediate future.

Among the companies named in the survey will be found many distributors of manufactured or natural gas, demonstrating that central butane-propane plants give flexibility to established gas service.

In offering this survey of the current central plant situation *Western Gas* acknowledges with appreciation the ready assistance rendered by the many companies returning information presented.

Lindsey Now General Manager Natural Gas Corp. of Calif.

THE appointment of E. M. Lindsey as general manager of Natural Gas Corp. of Calif., has been made during the past month by officials of this organization.

This appointment came co-incident with the moving of the executive offices of Natural Gas Corp. of Calif., Natural Gas Corp. of Wash., and Natural Gas Corp. of Ore., from their former headquarters at 200 Bush Street to 225 Bush Street, San Francisco. This move included the offices of R. E. Aitcheson, executive vice-president, T. E. Bartlett, manager of sales and J. M. Loyd, auditor of the company.

E. M. Lindsey

Operating headquarters of Natural Gas Corp. of Calif. will continue at 200 Bush Street, under the direction of Mr. Lindsey, while operating headquarters of Natural Gas Corp. of Wash. and Natural Gas Corp. of Ore. will continue in recently established headquarters in the Pacific Building at Portland, Ore.

Mr. Lindsey has been with the Natural Gas companies for the past several months, first as engineer for Standard Management and Operating Corp., actively engaged in utility construction and operation throughout the Pacific Coast area, and then as general superintendent of the trio of Natural Gas organizations. With his new appointment as general manager of Natural Gas Corp. of Calif. he will be in active charge of all properties of the company, which now include butane plants in operation at Vacaville, Rio Vista, Isleton, Suisun, Fairfield, Brawley, Calexico, El Centro, Dunsmuir and Yreka, with a plant and distribution system soon to be completed at Arcata.

Several promotions in the field offices of Natural Gas Corp. of Calif. and Natural

Gas Corp. of Ore. have also been announced.

These include the appointment of R. L. Hayden as manager of the Imperial Valley District of the company, replacing L. C. Butler who is now doing some special sales work in the northeastern properties of the organization. Mr. Hayden has been sales supervisor for the Vacaville group of properties for the past several months.

J. T. Hopkins, who has been acting district manager at El Centro, is taking up new duties in the tank gas division of the company.

J. D. Wagner, formerly local representative at Rio Vista and Isleton, has been named district manager of the Vacaville group, with headquarters at Vacaville. Howard Clark, service man at Vacaville has been given the position of local representative under Mr. Wagner, with John Verhalss occupying a similar position at Suisun-Fairfield, Clarence Josselyn at Rio Vista and P. J. Benedict at Isleton. In this same group of properties George Byrne takes over the duties formerly held by R. L. Hayden.

Glenn H. Merritt, local representative at Vacaville since this plant first went into operation has been transferred to Dunsmuir, Calif. S. R. Sharpton, local representative at Dunsmuir goes to Klamath Falls, Ore., where he replaces L. J. Rust, resigned.

J. C. Slaven, who also has been at Suisun-Fairfield since the first plant began operating, has been given a similar position at Calexico, and T. G. Knowles has been transferred from Yreka to Arcata, where a plant will soon be ready to go into service.

Rockgas Has the Floor at Vancouver Boat Show

Rockgas, Ltd., Vancouver, B.C., recently staged an attractive exhibit at Vancouver's first boat show, which was held in the Arena. The company participated in the display for the purpose of showing how Rockgas may be used on board pleasure and commercial craft. The firm had a large booth in which heaters and ranges were shown in operation, fuel being supplied from the Rockgas cylinders. Equipment was also installed on several of the boats shown in the display.

Boeing Aircraft of Canada, Ltd., which also controls Hoffar-Beaching Shipyards, staged an independent display at the company's ship-building plant, where large cruisers constructed by the firm were exhibited with Rockgas equipment.

Caloroptic—a New Direct Reading Calorimeter

Connelly Iron Sponge and Governor Co., New York and Chicago, announces a new direct reading calorimeter called the Caloroptic, which reads in B.t.u's, without the employment of calculations for corrections for barometer, thermometer, pressure, etc. It is a modified form of Bunsen burner, the indicator for reading being the point of exact elimination of the illuminating tip of the inner cone of the Bunsen flame, the point of complete combustion of the gas. The Caloroptic has the usual Bunsen burner tube and in addition, a screw sleeve revolving on the burner tube at its base, which sleeve regulates and measures the air supply.

The company has also placed on the market a new high pressure service regulator and a combination valve.

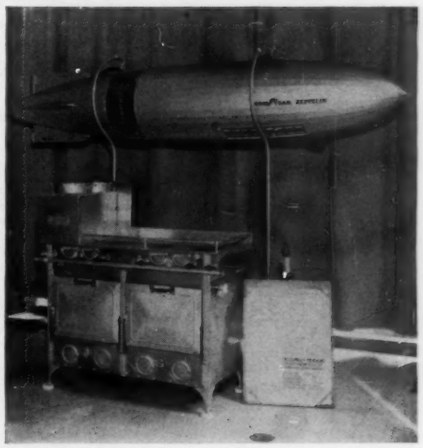
Propane-Fueled Range for Dirigible

WHEN the giant U. S. Navy Dirigible "Akron," ZRS 4, takes to the air her galley will be fitted with a modern gas range burning propane.

Special light cylinders, designed for the purpose, will store a liquefied propane supply sufficient to permit staying aloft approximately 12 days without landing.

The range was built by the Tappan Stove Co. of Mansfield, Ohio. Requirements called for a heavy duty, large capacity range, yet light in weight. The engineers of the U. S. Navy and the Goodyear-Zeppelin Corp. of Akron, Ohio, placed a maximum of 110 lbs. on the weight of the stove. Metals not ordinarily used in gas range construction were therefore employed, with cast, and sheet aluminum predominating. In lesser proportions other metals were used, including chromium plated steel, nichrome, stainless steel, magnesium, cast iron and bronze.

The range is flame-proof and has no open flames exposed to the air of the galley. The air for the burners enters through flameproof gauze which excludes the flame from the galley itself. The two large ovens of the range are thermostatically controlled so that a predetermined heat may be maintained. The top of the stove is solid cast aluminum with iron plates directly above the burners. Each top burner is provided with a flueway so that from front to rear the entire top of the stove is hot enough for cooking purposes. On the left section of the stove is a compartment which holds two large stock pots for use in preparing large quantities of food and keeping them heated and ready to serve.



Propane-fueled light weight gas range, to be a part of the U. S. Navy's dirigible "Akron's" equipment.

The range has capacity to feed the crew of the dirigible, which will number as many as 50 men.

This giant airship, on which propane fuel will shortly be rendering an important service, is 785 ft. long, 132 ft. in diameter and has a cruising radius of about 14,000 miles (with a speed of 83 miles per hour).

Contract Let on New Pomona District Office for So. Counties

Contract for construction of the new Southern Counties Gas Co. district office building to be erected at Main and Holt Streets in Pomona, Calif., has been awarded, work to begin immediately, according to officials of the company.

The structure will cost, including site and new furnishings, approximately $80,000.00. It will be of Class A construction, and two stories high.

Schools of Terrell, Texas, Install $4,000 Equipment

More than $4,000 in sales of appliances and piping to schools in the area surrounding Terrell, Texas, is the record of the Community Natural Gas Co. office at Terrell for last season. This amount includes 27 cabinet type heaters divided among the schools in Urbandale, Seagoville, and Mabank.

Arkansas Valley Gas Co. Plans to Extend System

Arkansas Valley Gas Co., headquartered at Rockyford, Colo., has applied for permission to construct and operate natural gas distribution systems in several towns near Fort Lyons. Supply will come from the Colorado-Interstate Gas Co. carrier from Amarillo to Denver.

De Queen, Ark. to Have Natural in Seven Months

The city council of De Queen, Ark., recently granted a franchise to the Public Utility Corp. of Arkansas, a subsidiary of the Arkansas Natural Gas Corp., to construct a distribution system and deliver natural gas to the citizens of the town for a period of 25 years. The system is to be completed within seven months from date of franchise.

Supply of gas will be transported by the Arkansas-Louisiana Pipe Line Co. through about 25 miles of line to be extended from the line originally constructed to supply gas to the Okay Cement Plant at Okay, Ark.

Northwestern Natural Gas Co. Announces Change in Set-Up

Northwestern Natural Gas Co., headquartered at Grandview, Wash., late in April announced the reorganization of its financial structure, the present organization, the Northwestern Natural Gas Co. of Kansas and the Northwest Oil and Gas Co. of Washington, continuing as subsidiaries of a holding company to be known as the Northwestern Natural Gas Corp. of Delaware.

Boynton Named Rate Attorney For Central Public Service Corp.

Ben B. Boynton of Springfield, Ill., has joined the headquarters staff of Central Public Service Corp., Chicago, Ill., as rate attorney. He will supervise the preparation and handling of rate cases in which subsidiaries of the company are involved.

TABLE NO. 4. RIVER CROSSINGS.

Streams Crossed	Type of Crossing	Width of Valley Subject to Flood (Feet)	Width of Channel (Feet)	Normal Depth of Water (Feet)	Distance Header to Header (Feet)	Lineal Feet of Pipe Used 10-In.	16-In.	18-In.	Characteristics
Canadian River	4—10-in. lines across stream	4,500	3,900	3	6,667	27,464			Quicksand. Low most of year. Subject to fast rise amounting to a "wall" of water; falls quickly.
Beaver River	5—10-in. lines across stream	4,000	135	3	4,728	26,624			Narrow, shallow, sandy. Subject to sudden rise and fall. Normally sluggish.
Cimarron River	5—10-in. lines across stream 3—10-in. lines across stream	3,100	100	3	3,400	18,409 9,406			Same
Arkansas River	6—10-in. lines across stream	2 miles	230	3	5,850.5	38,159			Shallow, narrow, low banks, large amount quicksand in stream bed, and on sloping banks.
Neosho River	6—10-in. lines across stream 2—18-in. lines across flood plain	18,000	230	6½	18,500 (18")	6,797		33,955	Deep, narrow channel. Wide, marshy flood plain.
Osage River	6—10-in. lines across stream 2—18-in. lines across flood plain	7,100	225	5	7,600 (18")	17,820		9,524	Same
Lamine River	6—10-in. lines across stream 2—16-in. lines across flood plain	3,200	110	8	3,500 (16")	15,977	6,951		High limestone bluffs. Narrow, crooked channel. Rises due to back water from Missouri River.
*Missouri River	6—10-in. lines across stream and portion of flood plain. Subject to frequent inundation	4,700	1,960	25	4,795	27,543			Wide, forms bars quickly. High limestone bluffs. Wide flood plain. High water usually in June. Channel being straightened and widened under Government supervision.
*Mississippi River	22-in. pipe on highway bridge 2—18-in. lines across flood plain	5 miles	1,500	20		Under construction			Wide, deep channel under Government supervision. Contains large number of sand bars. Wide flood plain on east side protected by levee. Similar to Missouri River.
*Illinois River	5—10-in. lines across stream 2—18-in. lines across flood plain	4 miles	847	14		Not constructed			Straight, narrow, deep channel under Government supervision. Medium current. Wide flood plain on east side protected by levees. Moderate rise and fall.
Brush Creek	5—10-in. lines across stream	950	75	3		Not constructed			Small creek. Narrow, winding, shallow. Comparatively short in length. Flows into Sangamon River.
Horse Creek	5—10-in. lines across stream	975	90	3		Not constructed			Same.
S. Fork Sangamon River	4—10-in. lines across stream	1,000	100	3		Not constructed			Same.
*Wabash River	5—10-in. lines across stream and flood plain	2,600	680	4½	4,373	22,244			Wide, deep, straight channel. Sluggish. Narrow flood plain. High limestone bluffs.
Big Raccoon Creek	4—10-in. lines across stream	1,300	217	4	1,485	5,940			Narrow, deep channel. Narrow flood plain.

*Navigable streams.

Constructing the Panhandle Eastern 1000-Mile Pipe Line

of the main pipe line. This header consists of a joint of pipe the same size as the main line closed at each end, with an orange peel type of weld, and welded into the main line at right angles to it, at the center of the header. On the opposite side of the header, the 10-in. lines are welded in at right angles.

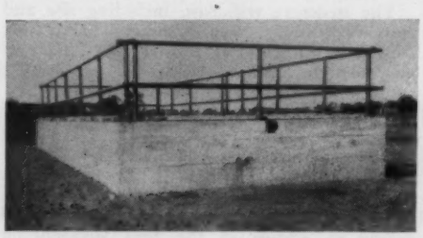
On each side of the 10-in. lines near the header a gate valve is placed, and immediately ahead of this valve a blow-off valve to relieve the pressure in the 10-in. line when necessary. This river crossing header is strapped and bolted to a concrete pier, the base of which is carried to firm soil. As the 10-in lines are laid across the river valley and the river channel, each line is bowed up-stream in order to provide sufficient slack for the settling of the lines in the stream bed and to keep the pipe and welds under compression instead of tension. The amount of the bow or slack put in the lines depends on the nature of the river bed and the depth, character, and velocity of the stream. The river pipe is acetylene welded throughout, no couplings being used.

River pipe used was 10¾-in O.D. in mill lengths of about 40 ft. and weighing 40 lbs. per linear ft. Each weld was reinforced with welding straps ½x1½x10-in. long by electric arc welding. Cast iron river clamps weighing approximately 1300 pounds per set were bolted to the lines at 20-ft. intervals, one clamp being placed over each weld.

The Neosho, Osage and Lamine Rivers have wide flood plains on one or both sides which are subject to overflow, remaining

(Continued from Page 68)

under water several days or even a week at a time. The headers for the 10-in. lines crossing these streams were placed at convenient points on each side of the channel



South header gatebox—Arkansas River 24-inch main line in Kansas.

Header gates South side Cimarron River.

which would not be covered with water in periods of normal flood, yet in periods of excessive high water would be submerged. From these 10-in. headers on each side to a point well above any known flood stage, two 18-in. or 16-in. lines were laid. By placing gate valves in the proper places, this type of manifold construction consists in reality of two separate crossings.

The crossings of the Canadian River in the Texas Panhandle was in a bad quicksand bed. The crossing was made with four 10-in. lines. The distance from header to header was 6,667 feet. These lines were acetylene welded in five-joint sections and pulled into the river bed by tractors. The ditch was dug as deep as possible by hand and the line was lowered. The sand was then dug from beneath the pipe until it was 18 in. in the sand. The line was then covered.

The distance between the lines was 95 ft. in the center of the river. The lines were left disconnected at the headers for 30 days to allow settling without strain on the header connections. During the laying of the last 10-in. line, a wall of water approximately 10 ft. in height came down the river without warning, sweeping men, machinery, and pipe down the stream. No lives were lost, but a tractor and an electric welding machine were submerged in the quicksand. Three thousand feet of this line was bent downstream to a 90 degree bend without breaking the line. This was cut, pulled back and welded into the crossing, with a loss of only 300 feet of pipe. After all lines were settled, another

Welsbach
HOTZONE
SELF-ACTION GAS WATER HEATER

Member American Gas Association

Beauty *Hot Water is Essential*

Health . . . Cleanliness . . . Convenience

Welsbach Water Heaters have been improved until they truly are beautiful pieces of household equipment.

Public acceptance has materially increased the sale of Hotzone and Stazhot Heaters.

Welsbach Products . . . Always Dependable . . . None Better

WELSBACH COMPANY, GLOUCESTER, N. J.

50 Hawthorne Street, San Francisco, Calif. **226 S. Wabash Avenue, Chicago, Ill.**

TABLE NO. 5—RESULTS OF LEAKAGE TESTS

Section	Miles	Diameter Inches	Equivalent 3 in. Pipe at 100 lbs.
Main Line, Oil City to Liberal compressor station	108	22	17,000 cu. ft. per mile per year
Main Line, Liberal compressor station to Gate No. 20	165	24	11,000 cu. ft. per mile per year
Hugoton gathering line	38	16	10,000 cu. ft. per mile per year

flood, 20 feet high, came down but the lines remained intact.

In the crossing of the Arkansas River, only 10-in. lines were used. The location of the headers on each side of the channel for these lines is subject to frequent inundation. Due to the large amount of underlying quicksand at these header locations, it was necessary to drive piling beneath each header. The piling for each header consisted of 80 pieces of second hand 6-in. drill stem 30 feet long. After driving with a pile driver, they were filled with concrete. Concrete boxes were then placed around the entire header. They were 30 ft. long by 10-in. wide by 8 ft. deep. In times of flood, it will be possible to operate the valves of these headers from the top of the concrete boxes. The main line for a distance of 2500 ft. from each of these header boxes was anchored and placed in the quicksand with "Never Creep" anchors. Concrete blocks were poured over all of these straps and anchors, the pipe being wrapped with tar paper before the blocks were poured. Each concrete block was 4 ft. wide by 6 ft. long by 3 ft. deep. In all, 180 of the blocks were used.

Several methods were used in laying the pipe across the channel. Sometimes it was pulled across by tractors; in some cases, the ends of the pipe were bull-plugged and the pipe floated and pulled into place; and in the case of the Missouri River, the pipe was laid across the channel from barges.

Data pertaining to the above mentioned river crossings is given in Table No. 4.

A telephone line is planned to provide the following services:

1. Patrol service with stations located approximately every 8 miles, which may be opened by patrol men for communication with the dispatcher, whose office will be at the Louisburg compressor station.
2. Telephone facilities between important points, such as terminals, junctions, pumping stations, and the dispatcher's office. This classification includes about 20 telephones.
3. Facilities for temporarily connecting a test set in the field for emergency use between stations.
4. Telegraph service on a Simplex Basis at important points. The dispatcher's office is at a central point from which separate circuits are run to each extremity of the line, these circuits being approximately 570 miles long each.

To avoid right of way difficulties due to cultivated fields the line was located on public highways, thus following a zig-zag course along the general route of the pipe line and adding approximately 20 per cent to length.

The pole line is generally of poles 20 ft. long using 8 pound Rueping treatment International Creosoted yellow pine poles with 5-in. tops, spaced 35 to the mile. Line wire is No. 8 BWG hard drawn bare copper wire, 435 lbs. per single wire mile.

Ten-pin fir cross-arms and No. 42 type glass insulators were used. Transpositions were made so that the maximum length of a complete section is 20,800 ft. Transposition points are approximately 1300 ft. apart. General construction of the line followed standard practice of the American Telephone and Telegraph Co., and general practice of the Bell Telephone Companies.

Contract for the telephone line was let to Dwight Chapin, Jr., of Wichita, Kansas.

When completed this system will be the longest telephone system in the United States, except for the systems of the Bell and those owned by the New York Central and Pennsylvania Railroad.

Testing the Completed Line

The line has been tested at this writing for a distance of 273 miles from the Texas end, the pipe being elevated back of each 8-mile gate valve successively and blown thoroughly with gas to clean the line before testing. After the line was blown it was flanged up to the gate and pressure built up. Maximum pressure applied to the line was 450 lbs. per square inch.

The line was tested for leakage by the "shut in pressure drop" method as approved by the U. S. Bureau of Mines, measuring pressure drop by a dead weight gauge, correcting for temperature, and reducing the result to equivalent yearly leakage per mile of 3-in. pipe at 100 lbs. per square inch pressure, expressed in thousands of cubic feet of gas at 14.7351 lbs. and at 60° F. and a pressure of 30-in. mercury at 60° F.

Results of leakage tests so far as conducted at this writing are given in Table No. 5.

The above results are notable as compared with the finding of the Bureau of Mines over a long series of tests by this method, the average leakage, as quoted by E. L. Rawlins, being from 100,000 to 200,000 cu. ft. equivalent 3-in. pipe per mile per year.

Memphis Natural Service Expanding

By D. C. SHAFFER

Vice-President and General Manager, Memphis Natural Gas Company

ON December 31, 1928, natural gas was turned into the 210-mile 18-inch Dresser coupled line, from the Monroe-Richland field, Louisiana, to Memphis, Tennessee.

The Memphis Natural Gas Co. buys gas under a long-time contract from the Industrial Gas Co. and other companies having large reserves in the Monroe-Richland fields of Louisiana, and delivers to the Memphis Power & Light Co. for distribution and for its generating station. Gas is also delivered to the Louisiana Power & Light Co., Arkansas Power & Light Co. and Mississippi Power & Light Co. for distribution in some 30 towns along the 210 miles of pipe line. The Memphis Natural Gas Co. also operates 30 miles of pipe line from the 18-inch line to serve Lake Village, Dermott, Wilmot and McGehee, Arkansas; and 50 miles of 8-inch to supply five small towns in Mississippi, terminating at Greenwood, Miss.

The Memphis Natural Gas Co. is now buying right-of-way and making survey for a 125-mile pipe line from Memphis to supply a number of towns in western Tennessee. On this project, the West Tennessee Power & Light Co. will be the distributor. The Memphis Natural Gas Co. is also planning an additional compressor station to be built on the 18-inch line south of Memphis.

The annual potential load replacing all other fuels in Memphis and small towns along the 18-inch line is estimated to be 19 billion cubic feet. About four billion of this amount, for various reasons, will be impossible to secure, which would leave a potential replacement load of 15 billion. Of this potential load, 42 per cent was secured during the first year, 1929; by the end of the second year, 1930, 61 per cent had been secured; and we estimate at the conclusion of 1931 we will have secured 80 per cent of the replacement load.

Memphis, and adjacent territory, are growing very fast industrially, and there is every reason to believe the potential load will increase substantially in line with this development.

Midwest Gas Association Holds 26th Session

THE 26th Annual Convention of the Midwest Gas Association, made up of members from Iowa, Minnesota, Nebraska and North and South Dakota, was held in Dubuque, Iowa, April 13 to 15, with John M. Drabelle, president, in charge. Mr. Drabelle turned the duties of president over to John K. Swanson, vice-president and general manager of the Minneapolis Gas Light Co., Minneapolis, Minn., newly elected to that office. Other officers named for the coming association year are: First vice-president, W. E. Derwent, Rockford, Ill.; second vice-president, Robert L. Klar, Des Moines, Iowa; secretary-treasurer, Roy B. Searing, Sioux City, Iowa.

John K. Swanson

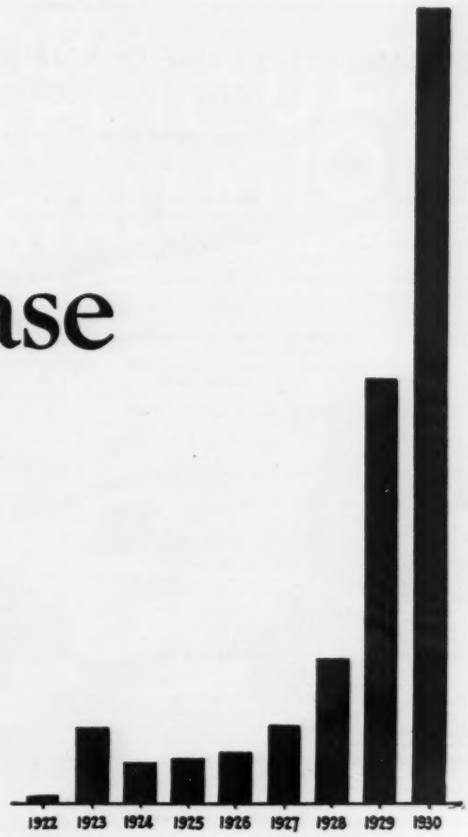
The fact that natural gas has, during the past year, found its way into many cities and towns in the association area, brought that subject into prominence, with addresses by E. C. Kollock, engineer of Southern Cities Public Service Co., and Fred J. Gunther, Iowa Nebraska Light & Power Co., Lincoln, Neb. Mr. Kollock took for his subject "Natural Gas Distribution and Its Problems," while Mr. Gunther talked on "Changing Over Consumer Equipment to Natural Gas."

Alexander Forward, managing director of the American Gas Association, represented the national association on the program.

Following several sessions packed full of interesting papers and reports, and the customary annual banquet, the meeting came to a close. The local committee in charge of arrangements consisted of Mrs. E. W. Eustace, hostess; George Taylor, George McLean, Frank A. O'Connor.

88% Increase

in Gas Main and Pipe Line Construction



In 1930 our gas main and pipe line construction was 88% greater than in the previous year. And in 1929 this work showed an increase over 1928 of 150%.

The experience of our organization, trained in gas main and pipe line construction, is available for work of any character, in congested districts, cross-country, river crossings, etc.

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DIVISION OF
UNITED ENGINEERS & CONSTRUCTORS
INCORPORATED
DWIGHT P. ROBINSON, PRESIDENT

Philadelphia
112 North Broad Street

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MAXIMUM RETURN TO CLIENTS PER DOLLAR INVESTED

GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

(Continued from Page 41)

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
KANSAS (Continued)					
Missouri Valley Pipe Line Co.	Garden City, Kan. to Sublette	31	8	Completed, 1930	225,000
Panhandle Eastern Pipe Line Co.	Main line to Mildred	50	..	Completed, 1930	.....
Peoples Gas Co.	Public Service Co. of Kan. line, to Greensburg, Kan.	7.51	3	Completed, 1930	200,300
	Public Service Co. of Kan. line, Pratt to Stafford and St. John	18.33 13.22	6 4		
Strong City Gas Co.	Strong City to Gregory Ranch	2.2	2 and 3	Completed, 1930	2,000
Marion Co. Pipe Line	Sec. 21-19-5 Chase Co. to Florence	16	2 and 4	Completed, 1931	17,210
Union Gas Corp.	Crandall to Le Roy	5	5	Completed, 1930	15,000
United Gas & Pipe Line Co.	Hays to Ellis	16	6	Completed, 1930	60,000
Southern Gas Line Inc.	Urania to Antonio	20	12¾	Completed, 1931	225,000
Southern Gas Line Inc.	Fairbanks to Monroe	9	12¾	Completed, 1930	200,000
Southern Gas Line Inc.	Paradise to Tioga	5	3 and 4	Completed, 1930	15,000
Sabine Gas Co.	Zwolle to Many	10	..	Completed	.....
United Gas System	Louisiana-Texas state line to Franklin	140	14 and 12	In progress	.....
United Gas System	Main line to Marksville	80	8	In progress	.....
United Gas System	Laterals	150+	8	In progress	.....
United Gas System	Terrebonne field to Morgan City and Thibodaux	50	..	Projected	.....
United Gas System	East Carroll field to Delhi, Tallulah and Oak Grove	60+	..	Completed, 1930	.....
United Gas System	Bogalusa to Covington, Hammond, Ponchatoula, Amite	100+	..	Projected	.....
MISSOURI					
Arrow Pipe Line Co.	Avondale to Liberty	11.0	5	Completed, 1930	44,400
Arrow Pipe Line Co.	Smithville to Avondale	3.0 20.0	3 5	Completed, 1931	185,000
	Smithville to Cameron	20.0	5		
Panhandle Eastern Pipe Line Co.	Laterals from main line to Moberly, Fayette, Jefferson City	100+	..	Completed, 1930	.....
Western Service Corp.	State line to Deepwater, laterals Merwin, Adrian, Eldorado Springs	50	8, 6 and 4	In progress	.....
Cities Service Gas Co.	Ottawa, Kan. to Sedalia, Mo.	110	12	Completed, 1930	.....
Cities Service Gas Co.	Bethel & Welborn Fields	5.5	6	Completed	.....
Cities Service Gas Co.	Sedalia line to Carrollton, Lexington and Marshall	80	8, 6 and 4	Completed, 1931	.....
MONTANA					
Billings Gas Co. and Ohio Oil Co.	Dry Creek field to Bozeman, etc.	120	8	In progress	2,500,000
Cutbank Gas Utilities Co.	Headlight Butte field to Cut Bank	7	4	Completed, 1930	18,000
Drumheller Interests	Cut Bank field to Spokane, etc.	250	..	Proposed	15,000,000
Lewistown Natural Gas Co.	Armells wells to Lewistown	25	8	Proposed	.....
Minnesota Northern Power Co.	Telstad Jct. to Whitlash Dome	38	10	Completed	.....
Montana Power Co.	Cut Bank field to Butte, Anaconda, etc.	250	20	Proposed	15,000,000 (Estimated)
Northwest States Utilities Co.	Great Falls to Lweistown	100	8	Proposed	.....
NEW MEXICO					
Albuquerque Natural Gas Co.	Kutz Canyon field to Albuquerque and Santa Fe	94 45 56	10 12 8	Completed 1930	.....
Southern Union Gas Co.	Albuquerque to Belen	35	6	Completed, 1930	.....
Southern Union Gas Co.	Santa Fe line to Las Vegas	50	..	Proposed	.....
Southern Union Gas Co.	Clovis to Tucumcari	65	6	Completed, 1930	.....

1930-1931 Pipe Line Progress

(Continued from Page 41)

chises having been obtained in El Dorado, Adrian, Appleton City, Montrose and Butler. The company recently acquired the interests of T. S. Salathiel and associates of Independence, Kan. in the Commercial Gas Pipe Line Co., serving gas in Moran, Blue Mound, Mound City, Pleasanton, and Bronson, Kan., and Nevada, Mo.

Arrow Pipe Line Co., Kansas City, Mo., has added a total of 132 miles of gas transmission line taking natural gas to 36 towns served by the General Utilities Co. in northeastern Kansas and northwestern Missouri, with service scheduled to start in eight more Missouri towns in June, 1931.

OKLAHOMA

Natural gas companies operating in Oklahoma broke previous year records by adding approximately 600 miles of new lines, ranging up to 24-inch in sizes at a total cost of $6,000,000, according to estimates of the Oklahoma Utilities Association. Among developments the following merit special notice.

Oklahoma Natural Gas Corp., Tulsa, Okla., in 1930 completed 84 miles of 16-, 12-, 10-, and 8-inch pipe line, taking gas from the Quinton field to Muskogee and Baldhill, Okla., and in addition completed a line between Eufaula and Checotah, serving those two towns through a distributing subsidiary.

Southwestern Natural Gas Co., Appalachian subsidiary, announced completion of its 112-mile line from the Quinton field to Muskogee, Sapulpa and Boynton, in October. The line is supplying gas for industrial purposes in a number of cities and towns in the area.

Cimarron Utilities Co.: Following completion of its line in the bottleneck of Oklahoma, Cimarron Utilities is planning to extend a 5-inch carrier from Guymon to Keyes and Boise City, 55 miles to the west. Cost of the project is estimated at $214,281.

ARKANSAS

Arkansas Western Gas Co., a Southern Union Gas Co. subsidiary, in 1930 completed construction of a 112-mile 8-inch line from the Clarksville gas field to serve Fayetteville, Rogers, Bentonville and Siloam Springs, Ark.

Memphis Natural Gas Co.: Several Arkansas cities and towns are scheduled for natural gas during 1930 if plans of the Memphis Natural Gas Co. mature. One line will leave the Memphis Natural 18-inch carrier from Monroe fields at a point near Helena, Ark. A 10-inch line will extend through Helena to Marianna, and from there an 8-inch will run northward to Forrest City. A second line will extend to Brinkley, with a 6-inch lateral to Augusta. From Memphis, the company plans to carry a 12-inch line to Covington, with extensions projected on the Arkansas side to Blytheville, Osceola, and Ripley, Ark., and Caruthersville, Mo. The Covington line is now being extended to serve Dyersburg, Hum-

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NATIONAL PIPE

GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
NEBRASKA					
Iowa-Nebraska Light & Power Co.	Aurora to York	22	6	Completed, 1930	.....
Iowa-Nebraska Light & Power Co.	Fairmont to Exeter	9	4	Completed, 1930	.....
Missouri-Valley Pipe Line Co.	Main line near Wabash to 5 miles East of Lincoln	10	20	Completed, 1930	190,000
Missouri-Valley Pipe Line Co.	5 mi. E. of Lincoln to Leshara	35	20	Completed, 1930	770,000
Missouri-Valley Pipe Line Co.	Main line to Fairbury	15	6	Completed, 1930	100,000
Missouri-Valley Pipe Line Co.	Main line to Council Bluffs	14	16	Completed, 1930	340,000
Missouri-Valley Pipe Line Co.	Leshara, Neb., to Sioux City, Iowa	84	16	Completed, 1931	1,475,000
Missouri-Valley Pipe Line Co.	Main line to Seward and David City	66	6	Completed, 1930	750,000
Missouri-Valley Pipe Line Co.	Wabash to Louisville	6	8	Completed, 1931	43,500
Missouri-Valley Pipe Line Co.	Main line to Sterling, Tecumseh, Auburn, Pawnee City, Humboldt	40	6 and 4	Completed, 1930	410,000
Nebraska Natural Gas Co.	Kan.-Neb. state line to Giltner	58.040	16	Completed	.....
Nebraska Natural Gas Co.	Giltner to Grand Island	17.6	12 and 8	Completed	.....
Nebraska Natural Gas Co.	Grand Island 12 inch to Grand Island Power Plant	1.994	8	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Hebron	5.15	4	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Deshler	.81	2	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Chester	.546	2	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Hastings	13.693	10	Completed	.....
Nebraska Natural Gas Co.	Hastings 10 inch to Minden	36.751	8	Completed	.....
Nebraska Natural Gas Co.	Minden 8 inch to Holdrege, Minden, Kearney, Gibbon, Shelton	12.989 30.913	6 4	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Edgar	3.890	2	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Aurora	11.53	8	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Clay Center	2.12	4	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Harvard	1.08	2	Completed	.....
Nebraska Natural Gas Co.	Main line 16 inch to Sutton	8.65 1.83	6 4	Completed	.....
Nebraska Natural Gas Co.	Sutton 6 inch to Fairmont	13.59	4	Completed	.....
Nebraska Natural Gas Co.	Shelton 4 inch to Wood River	9.053	4	Completed	.....
NORTH DAKOTA					
Minnesota Northern Power Co.	Glendive, Mont., to Williston, N. D.	110	12	Completed, 1930	.....
Minnesota Northern Power Co.	Cabin Creek Field, Baker, Mont., to Bismarck, N. D.	190	12	Completed, 1930	.....
Minnesota Northern Power Co.	Marmarth to Bowman	32	6	Completed, 1931	.....
Minnesota Northern Power Co.	Bowman to Hettinger	20	6	Proposed	.....
Minnesota Northern Power Co.	Williston to Minot	65	12 and 10	Proposed	.....
OKLAHOMA					
H. G. Newcomb	Canadian to Indianola	7	2¼ 3½	Completed, 1931	10,000
Cimarron Utilities Co.	Guyman to Keyes and Boise City	55	5	Proposed	214,281.48
Cities Service Gas Co.	Oklahoma City field to Dilworth	98.6	20	Completed, 1930	.....
Cities Service Gas Co.	Gathering lines	9.9 5.7 8.0 3.4	24 8 12 16	Completed	.....
Oklahoma General Gas Co. and Pioneer Gas Utilities Co.	Oklahoma City to Nichols Hills	2.4 .8 9.5	6 5 4	Completed, 1930	.....

boldt and Jackson, Tenn. Memphis Natural constructed a lateral from its main carrier to serve Greenwood, Miss., 50 miles distant, and it is planned to extend this line to other domestic markets in the district.

LOUISIANA

Probably no more marked change has taken place in natural gas development in any one state than that of the past year in Louisiana. A comparison of *Western Gas'* 1930 gas transmission line map with the 1931 edition (published in this issue) will give a clear picture of the projects which have gotten under way during the past year.

Southern Gas Lines, Inc., Monroe, La., has completed 30 miles of 12-inch line from Urania, Louisiana, to Antonio, and from Fairbanks to Monroe, looping its present line to Antonio at a cost of $450,000. Twenty miles of this line were constructed early in 1931, the balance being completed in 1930.

United Gas Co. of Houston, Texas, has under construction a 12-inch line across the southern parishes of the state, with laterals reaching out to the markets in central Louisiana. Construction has already begun on this carrier, which leaves the Magnolia Gas Co. line near Kirbyville, Texas, and penetrates the Louisiana Bayou territory, a mud-, mosquito-, and fever-ridden district where line laying proceeds under difficulties.

Following purchase by United Gas Corp. of the Southern Natural Gas Co. extension from its main line to Mobile and Pensacola, completed in 1930, the United organization announced formation of the United Gas Public Service Co. to act as principal operating subsidiary. The company owns and operates among others, the systems of the Dixie Gulf Gas Co., Dixie Gas and Utilities, Huston Gulf Gas Co., Magnolia Gas Co., and the South Texas Gas Co., and the Mobile-Pensacola system formerly owned by Southern Natural.

Construction is now under way on a line from the Jackson field in Mississippi, extending southward to serve 12 Mississippi towns. A second extension is planned by the company from Bogalusa to serve a score or more Louisiana towns, including Covington, Slidell, Hammond and Ponchatoula.

In Texas, the United Gas System has also contributed its share toward changing the natural gas transmission line map.

From the Boggy Creek field near Palestine, the company has completed a 6-inch extension, taking natural 100 miles south to Huntsville, Groveton, Crockett, Trinity, Lovelady and other communities. This line is to be extended to Conroe, 20 miles farther to the south.

From San Marcos, United extended a 12-inch loop to a point near Buda, with a 6-inch line extending from that point 80 miles south with Hallettsville as its terminus.

A 40-mile, 16-inch line was completed late in 1930 from Refugio to Pettus, connecting with the Pettus-Converse line of the Houston Gulf Gas Co. This company, a United Gas Service Co. subsidiary, looped its Refugio to Houston line, 80 miles of pipe being required to complete the loop.

On United Gas Corp.'s map of the Texas area, a line is shown projected from Austin to Wichita Falls, with a lateral joining the company's present system at Fort Worth. This line would tie in with the Northern Texas Utilities Co. line at Wichita Falls. The latter company was purchased in 1930 by United Gas Corp.

Texas Public Service Co., Austin, Texas, a subsidiary of Peoples Light and Power Co. has announced the beginning of work on a line which it will lease from West Coast Power Co. This 120-mile line consists of

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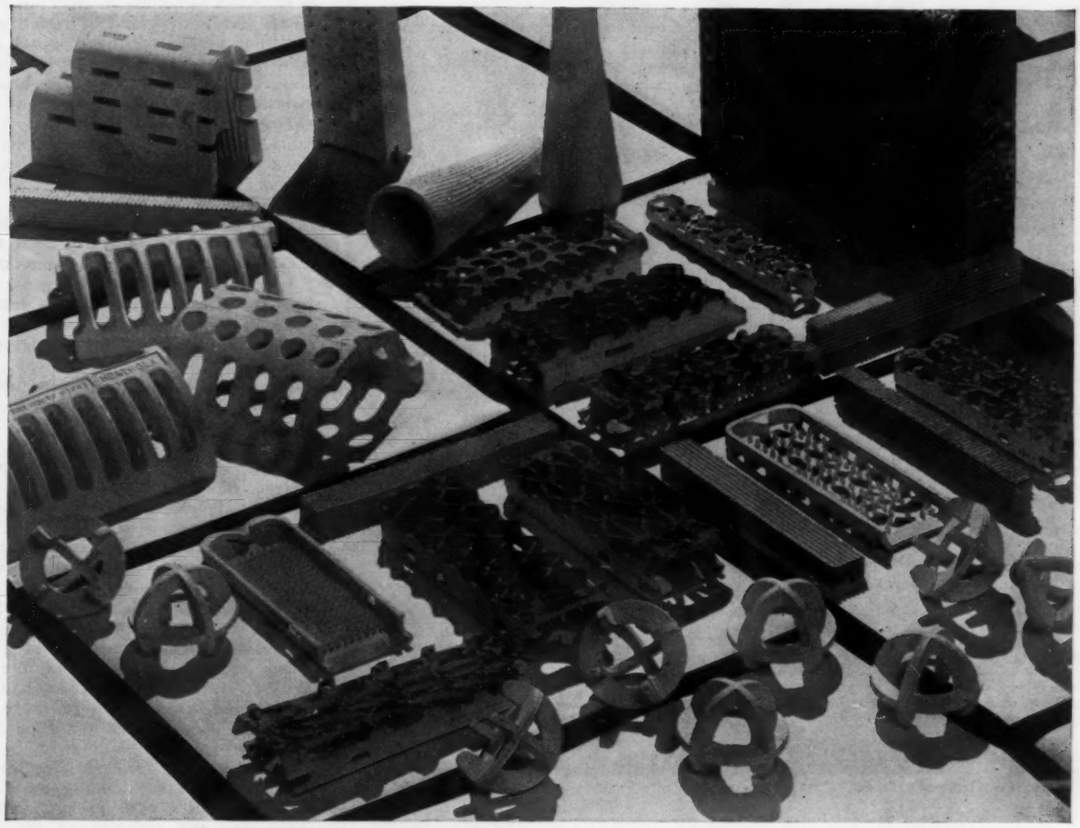

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GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
OKLAHOMA (Continued)					
Okla. Gen. Gas and Pioneer Gas Utilities Co.	Oklahoma City field to McLoud	16 11	4 5	.....	.....
Oklahoma Natural Gas Corp.	Quinton field to company system at Muskogee and Baldhill	62.5 5 6 10.5	16 12 10 8	Completed, 1930	.....
Public Service Co. of Okla.	McAlester to Krebs	2	6	Completed, 1930	10,000
Southwest Gas Utilities Corp. of Okla.	Section 27-T5N-R6E to Section 14-T7N-R6E	15	6⅝	Completed, 1930	150,000
Southwest Gas Utilities Corp. of Okla.	Section 1-T5N-R7E to Section 11-T7N-R8E	13	6⅝	Completed, 1930	100,000
Southwestern Natural Gas Co.	Quinton field to Muskogee, Checotah, Sand Springs and Tulsa	40 65 30	16 14 10	Completed, 1930	.....
State Fuel Supply Co.	Anadarko to Verden	7.75	4	Completed, 1930	.....
State Fuel Supply Co.	Mt. View to Gotebo	8.50	3	Completed, 1930	.....
State Fuel Supply Co.	Field to Laverne	7.75	4	Completed, 1931	.....
State Fuel Supply Co.	Laverne to Buffalo	11.25	4	In progress	.....
Western Service Corp.	Oklahoma City field to Guthrie	30	..	Proposed	750,000 (Estimated)
OREGON					
*Portland Gas & Coke Co.	Salem to Corvallis	27.639 36.928	6 4	Completed, 1930	249,770
*Portland Gas & Coke Co.	Tualatin to Newberg	12	6	In progress	47,500
*Portland Gas & Coke Co.	Gervais to Silverton	11.829	4	Completed, 1930	29,250
*Manufactured Gas.					
TEXAS					
South Plains Pipe Line Co.	Hereford to Farwell	50	6⅝	Completed, 1930	260,000
South Plains Pipe Line Co.	Lubbock to Farwell	65	6⅝ 4½	Completed, 1930	238,000
South Plains Pipe Line Co.	Littlefield to Levelland	20	3½	Completed, 1930	50,000
South Plains Pipe Line Co.	Summerfield to Dimmitt	18	3½	Completed, 1930	38,000
South Plains Pipe Line Co.	Abernathy to Petersburg	12	3½	Completed, 1930	25,000
South Plains Pipe Line Co.	Loop around Lubbock	8	10	Completed, 1930	45,000
Texas-Louisiana Power Co.	Bunger Plant, Phillips Pet. Co. to Graham	6.6	6	Completed, 1930	40,000
Southern Union Gas Co.	Laney to Hico	20	4	Completed	.....
Southern Union Gas Co.	Field to Navasota, Hempstead, Brenham etc.	100	6	Completed, 1930	.....
Utilities Fuel Supply Co.	Refugio to Victoria	40	8	Completed	.....
Empire Southern Gas Co.	Big Springs to South Plains Pipe Line Co.'s main line	34	8	Completed, 1930	.....
Houston Pipe Line Co.	Refugio to Fannin loop	25½	12	Completed	.....
Houston Pipe Line Co.	Midfields south through Blessing and Palacios	16	4	Completed	.....
Lone Star Gas Co.	To Brad compressor	6	12	Completed, 1930	.....
Lone Star Gas Co.	To Pueblo plant (field line)	6	10	Completed, 1930	.....
Lone Star Gas Co.	To Jack County (field line)	14	6	Completed, 1930	.....
Texas Gas Utilities Co.	Maverick County field to Del Rio	60	10	Completed, 1930	.....
Texas Gas Utilities Co.	Maverick County field to Piedras Negras	15	..	Completed, 1930	.....
Texas Gas Utilities Co.	Crystal Springs to La Pryor and Uvalde	50	4	Completed, 1931	.....
Texas Gas Utilities Co.	Carizzo Springs to Catarina	20	4	Proposed	.....
Texas Public Service Co.	Big Lake field to San Angelo	80	12	In progress	.....
Texas Public Service Co.	Big Lake field to Girvin Power Plant	40	8	In progress	.....
United Gas System	Boggy Creek field to Huntsville, etc.	100	6	Completed, 1931	.....
United Gas System	Huntsville to Conroe	20	6	Proposed	.....
United Gas System	Austin to Wichita Falls	240	..	Projected	.....

80 miles of 12-inch pipe extending northeast-ward from the Big Lake gas fields of Texas to San Angelo, and a 40-mile, 8-inch line extending from the field to Girvin, where it will supply gas to the power plant of the West Texas Utilities Co. Completion is expected sometime in May on this carrier. Texas Public Service Co., which will operate the line, purchased the original gas system serving San Angelo from Oklahoma Natural Gas Corp., both companies being subsidiaries of the Tri-Utilities Corp. of New York.

Texas Gas Utilities Co., an Appalachian subsidiary, in 1930 completed its line from the Rycade gas fields to Del Rio, extending service to the Central Power & Light Co. plant located on Devil's River. The line is approximately 63 miles in length. Since completion of this section, the company has constructed a line south from the field to Eagle Pass and Pierdas Negras. A second line has also been constructed from the field near La Pryor north to La Pryor and south to Crystal City and Carrizo Springs, with an extension projected to Catarina.

Lone Star Gas Co.: Construction activities of Lone Star were centered mostly in its work on Missouri Valley Pipe Line Co's. 24-inch line, Lone Star owning a 30 per cent interest in this development and having charge of the building of all compressor stations. However, during the course of the year the company completed a 25-mile line, taking service from its west Texas line near Abilene to serve Lawn and several other communities. The company also constructed 26 miles of 12-, 10- and 6-inch field lines.

Four compressor stations were completed on its own system by Lone Star in 1930-31—one each at Brad, Joshua, the Chickasha field in Oklahoma, and in Erath County, Texas, and in addition three were constructed on the Missouri Valley Pipe Line Co's. carrier.

Houston Pipe Line Co. in September announced plans for looping its Refugio-Fannin line with a 25½-mile, 12-inch auxiliary, increasing the capacity of the system. A 4-inch line approximately 16 miles long was constructed by the company from Midfields south through Blessing and Palacios. Another line which Houston Pipe Line Co. announced as completed in 1930 was the extension from its main Houston line out of Edna Station, to Long Point. Unusual construction difficulties were overcome in laying this line, rain and mud making it all hard going.

Southern Union Gas Co., Dallas, organized a comparatively short time ago, in 1930 finished several of its Texas projects. Completion of its Navasota-Eagle Lake line added seven towns to the list served. In west Texas a 6-inch line was completed by this same company to serve McCamey.

MOUNTAIN AREA

The major efforts of Southern Union, however, were turned toward the New Mexico market. In May the company began construction of its 195-mile line from the San Juan Basin in northern New Mexico to Albuquerque and Santa Fe. Twelve-inch pipe was used over a route which called for gas to be carried across the Continental Divide—an undertaking of large proportions. Completion was announced in November, with service started in Albuquerque and Santa Fe in December. This development called for a financial layout of approximately $5,000,000. An extension is serving Belen and Los Lunas, and a second is projected to serve Las Vegas, where a franchise has been secured.

For the first time, natural gas from Kansas fields is finding a market in the mountain area, with one line complete and another one beginning construction.

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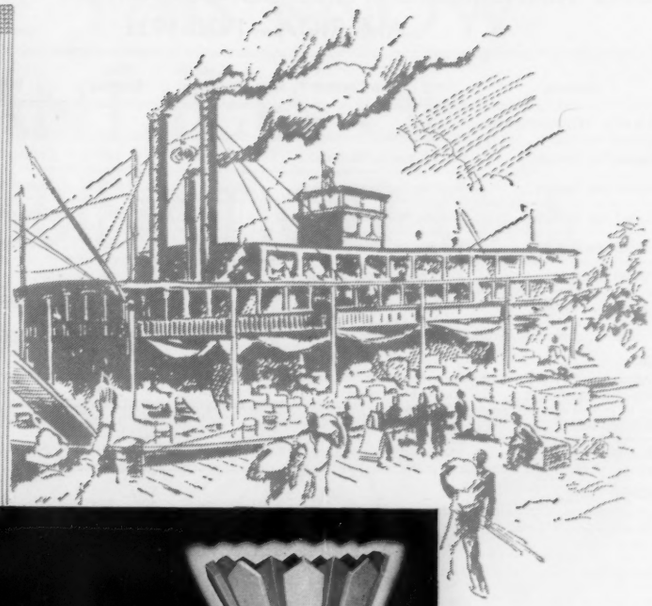
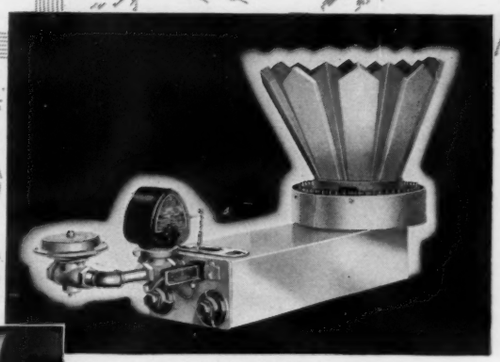
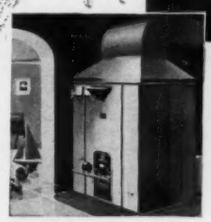




JANITROL



COLUMBUS FURNACE

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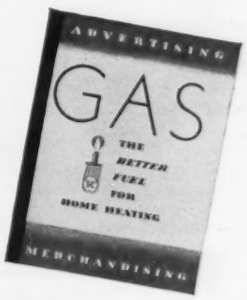

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GAS TRANSMISSION LINE CONSTRUCTION IN WESTERN AMERICA—1930-1931

Company	Line Location	Length (Miles)	Size (Inches)	Status	Cost
TEXAS (Continued)					
United Gas System	San Marcos to Bastrop	30	12	Completed, 1931	.....
United Gas System	Bastrop to Hallettsville	80	6 and 4	Completed, 1931	.....
United Gas System	Refugio to Pettus	40	18	Completed, 1930	.....
United Gas System	Refugio to Edna	60	16	Completed	.....
United Gas System	Edna to Houston loop line	20	16	.....	.....
United Gas System	Kirbyville to Sabine River, (state line)	20	16	In progress	.....
UTAH					
Wasatch Gas Co.	Garfield to Tooele	14.111	10¾	Completed, 1930	200,000
Wasatch Gas Co.	Midvale to Pleasant Grove	22.5	..	In progress	400,000
Wasatch Gas Co.	Pleasant Grove to Spanish Fork	20	..	Proposed	
WASHINGTON					
Northwestern Natural Gas Co.	Field to Grandview	26	6	Completed, 1931	.....
Northwestern Nat. Gas Co.	Grandview to Sunnyside	10	4	Completed, 1931	.....
Northwestern Nat. Gas Co.	Main line to Prosser	5½	4	Completed, 1931	.....
Northwestern Nat. Gas Co.	Main line to Mabton	4½	3	Completed, 1931	.....
Northwestern Nat. Gas Co.	Benton County to Walla Walla	8	40	Proposed	.....
*Seattle Gas Co.	Seattle to Kent	11 13.25	4 2	Completed, 1931 In progress	35,000 28,000
*Washington Gas & Elec. Co.	Puyallup to Sumner	3.21	4	Completed, 1930	8,600
*Washington Gas & Elec. Co.	Sumner to Auburn	9.40	4	Completed, 1930	22,946
*Manufactured Gas.					
WYOMING					
Minnesota Northern Power Co.	Billy Creek Field to Sheridan	50	8	Completed, 1930	.....
Mountain Fuel Supply Co.	Meter Sta. No. 6 W. Hiawatha to main line	3	8	Completed	32,000
New York Oil Co.	Lander to Fort Washakie	20	4	Completed, 1930	50,000
North Central Gas Co.	Sand Draw Fields to Guernsey, Torrington, etc., Wyo. and towns in Nebraska	227 10 78 63	14 12 10 8	Proposed	$6,000,000

Colorado Gas & Utilities Co., Denver, completed a 91-mile main line from the Hugoton field to Lamar, Colo., and 12 other Colorado and Kansas towns with an extension to Springfield. Approximately 250 miles of pipe were laid, mostly of 8- and 6-inch. The company was newly organized in the summer months, and is headed by A. J. Hardendorf.

Colorado Natural Gas Co. was formed in 1930 with its main objective the serving of natural gas in Colorado Springs through a 212-mile, 10-inch line from the gas fields of Stevens and Morton counties in Kansas. Plans have now matured on this line, and construction was expected to start by the first of May. An extension is planned to serve Canon City, Colo., and one to Fowler, Ordway, Olney Springs, Manzanola and other towns. Colorado Natural Gas Co. is headquartered at Colorado Springs and names Arthur K. Lee as president.

Colorado Interstate Gas Co., headquartered at Colorado Springs, completed construction of a 28-mile line from Pinion to Portland, where it serves the Portland cement plant. Cost of the line was estimated at $500,000. The new line joins the company's Amarillo-Denver carrier near Devine. Other lines constructed by the company during the year brought service to Fitzsimons General Hospital and to Aurora. The company also authorized expenditures of approximately $1,000,000 on compressor station facilities, constructing two 5,000 h.p. plants on its system, one at Devine, Colo., and a second 7 miles east of Clayton, N. M.

Colorado-Wyoming Gas Co. extended service to several towns during the past year, numbering among its new consumers Greeley, Johnstown, Ft. Warren and Ft. Logan. Aurora received service in March, 1931, and Longmont in April, while Brighton and Ft. Lupton were scheduled for service early in May, a 3-inch line being under construction at the time of this writing.

WYOMING

In Wyoming very little was done during 1930 in the way of actual construction of gas transmission lines. Northwest States Utilities constructed a 50-mile line from Billy Creek field to serve Buffalo and Sheridan, and New York Oil Co. of Casper completed a 20-mile line from Lander to serve Ft. Washakie.

North Central Gas Co.: However, a line project of major proportions was brought to light in 1930, construction details being worked out at the present time. North Central Gas Co. was formed as a subsidiary of New York Oil, to build a 400-mile line from Sand Draw fields near Lander, Wyo., to cities and towns of eastern Wyoming and western Nebraska. Tentative route of this line is shown on the *Western Gas* pipe line map in this issue.

Survey of the line is complete. The first 227 miles will consist of 14-inch pipe, the balance to be 8-inch. Between Wendover and Guernsey a lateral will extend to Laramie, consisting of 10-inch. There will be two compressor stations, one at Casper and one near Guernsey. Eastern terminus of the line is set as Bridgeport, Neb. En route to this city the line will serve Douglas, Orin Junction, Glendo, Wheatland, Torrington, Wendover, Guernsey, Fort Laramie, and Laramie, Wyo., and Henry, Lyman, Morrill, Mitchell Scottsbluff, Gering, Minatare, Bayard, and Alliance, Neb.

UTAH-IDAHO

Western Public Service Corp. completed franchising activity on its Ogden-Pocatello extension during the past year, securing its permit from the State of Idaho and from the individual towns on the route of the line. This carrier will be 100 miles long, serving eight Utah towns, and five Idaho communities, including Pocatello, the latter now using manufactured gas. Construction was scheduled to start with the coming of warmer weather.

Wasatch Gas Co.: Preliminary work on the Wasatch Gas Co.'s line to Spanish Fork, Springville, American Fork, Lehi, Provo, Pleasant Grove and others began in April. This line will serve towns formerly served with manufactured gas by Utah Valley Gas and Coke Co., that company's system having been purchased by Wasatch Gas Co., a subsidiary of Western Public Service Co.

MONTANA

Montana-Dakota Power Co., headquartered at Minneapolis, Minn., a subsidiary of Minnesota Northern Power Co., added better than 300 miles of gas carriers, the bulk of the construction being done between April and September, 1930.

The 110-mile, 12-inch line from Glendive to Williston was begun in April, 1930, with construction announced as completed in July. Traversing the Lower Yellowstone Valley, the line serves a score or more of communities. Following shortly on the heels of this development, construction on the 190-mile line to Bismarck from the Baker-Glendive field was begun in July, with gas turned into Bismarck mains on September 3.

Early in April, 1931, Montana-Dakota Power Co. announced purchase of the plant and distribution system of the Minot Gas Co., Minot, N. D., assuring the construction of the projected line from Williston to Minot. This line will be constructed in 1932, and in the course of its 100 miles will serve 16 towns.

Minnesota Northern Power Co., parent organization of Montana-Dakota Power, completed a 40-mile, 10-inch line from the Great Falls line to Whitlash field, and a 14-mile extension from this line to the Rogers-Imperial well in Alberta, this being the first gas transmission line to cross the International boundary between Canada and the United States.

Northwest States Utilities Co.: Consolidation of northern and central Montana natural gas interests under the Northwest States Utilities Co. was announced in July by the Minnesota-Northern Power Co. Through this consolidation, gas properties of Montana Cities Gas Co., Northern Natural Gas Development Co., Central Montana Utilities Co., Havre Natural Gas Co., Pondera Util-

PLANTS LIKE THIS KNOW THE ADVANTAGES OF FORNEY COMBINATION GAS AND OIL BURNERS

Forney Combination Gas and Oil Burner definitely assures the highest efficiency, maximum flexibility, and lowest maintenance costs. Where extreme service conditions prevail there is one dependable, and entirely satisfactory burner and that is,

Forney Combination Gas and Oil Burner

FORNEY

COMBUSTION ENGINEERING COMPANY

513 Central Bank Bldg. Dallas, Texas

ities Co., and the Sheridan Gas and Fuel Co. of Sheridan, Wyoming, came under the control of the new organization. Active management of the Northwest States Utilities is under the direction of Minnesota Northern. It was under this banner that the Buffalo-Sheridan line, mentioned at another point in this article, was constructed.

At the present time Northwest States Utilities Co. has one project to announce. A 100-mile line is under consideration, taking natural gas from the Great Falls 12-inch line to Lewistown, Mont., through an 8-inch carrier.

Northwest Gas and Transport Co.: In April, 1931, announcement was made of the formation of the Northwest Gas and Transport Co., headquartered at Butte, with Louis B. O'Neil as president. This company has under way an extensive drilling program in the Cut Bank field, and has signed contracts with Montana Power Co. of Butte, and the Anaconda Copper Mining Co., Anaconda, calling for the delivery of natural gas through a 250-mile line. Cost of the project will be between 10 and 12 million dollars. Montana Power Co., serving manufactured gas to Butte and Helena, and holding franchises in Bozeman, Livingston, Deer Lodge and Anaconda, will distribute natural gas for domestic purposes in these towns.

Pipe line construction will begin as soon as weather permits, and the main line will be 20-inch or larger, according to Mr. O'Neil. Compressor station facilities will require an outlay of approximately $1,000,000.

Billings Gas Co.; Ohio Oil Co.: Early in 1931, plans for a 120-mile line from the Dry Creek field in south central Montana to Bozeman were announced by the Billings Gas Co., of Billings, Mont., subsidiary of Ohio Oil. The contracts have been let for supplying, welding and stringing the pipe, and constructing the river crossings. Ten-inch pipe is being used on the river crossings, two lines already being complete across the Yellowstone River. Cost of the project is estimated at $2,500,000.

CANADA

Several efforts made in 1930 to extend Alberta's natural gas to Saskatchewan population centers came to naught—largely due to opposing coal and affiliated interests. Regina still remains the "largest city in America without gas service of any sort," having turned down all franchise applications.

Tri-Cities Utilities, Ltd., headed by C. O. Moore, asked for franchises in Regina, Moosejaw and Saskatoon, planning construction of a transmission line from the Kinsella and Wainwright fields in northern Alberta. City councils of Regina and Saskatoon negotiated a 20-year franchise with Tri-Cities Utilities, but when the matter was brought to a vote, the franchises applications were defeated by a small majority.

Natural gas is by no means out of the picture, however, with several other companies forming to have a try at the situation. A new organization, the Canadian Resources, Ltd. of Calgary, said to be backed by English capital, is reported to be planning franchise negotiations soon with the city of Saskatoon. Supply for the line contemplated by these interests is named as the Ribstone field in eastern Alberta.

THE PACIFIC NORTHWEST

Since the discovery of natural gas in the Rattlesnake Hills in southern Washington, programs have been announced by various companies, looking toward the development of this State's gas resources.

Northwestern Natural Gas Co., headquartered at Grandview, Wash., has pioneered this territory for natural gas, drilling wells and constructing pipe lines. During 1930 this company laid 46 miles of transmission lines and 50 miles of distribution systems. Since the first of the year a franchise has been secured in Walla Walla, about 50 miles southeast of the field. Additional wells have been brought in, assuring a supply of sufficient proportions to justify construction of a line to that city. Possibility of a line to Yakima has also been mentioned.

Among other projects of an exploratory nature in the Pacific Northwest, International Pipe Lines, Ltd., was formed, its organizers planning to carry on drilling operations near Lulu Island in Vancouver, and extending these operations to Whatcom County, Wash. Early in April a gas well was brought in by this company about 10 miles north of Bellingham. Some franchising activity has been carried on in this area by an affiliated organization, the Gray-Tac Oil Co., in Montesano and Aberdeen.

CALIFORNIA

Completing a year of intensive expansion, the natural gas industry of California in 1930 laid more than 600 miles of transmission lines, pipe diameters varying from 26-inch to 3-inch. Kettleman Hills and Buttonwillow fields supply a large per cent of the gas used in these lines.

Pacific Gas and Electric Co., San Francisco, led California companies in new mileage, with approximately 300 miles to its credit. This represents the completion of its system extending from a point on the Standard-Pacific line, near Martinez to Vallejo, Napa, Calistoga, Santa Rosa and Healdsburg, and the taking of natural gas to Sacramento and towns in that vicinity previously served with manufactured gas by the same company.

A 74-mile, 16-inch line was also constructed by the company from Vernalis to Sacramento, connecting with the Standard-Pacific line. Another connection to this line was made at Tracy, a 22-inch lateral being laid to the P. G. and E. line near Milpitas.

Pacific Gas and Electric Co.'s program for the current year includes extension of natural gas service to Marysville from Sacramento, and on to Chico and Oroville. The company at present operates a manufactured gas transmission line between Marysville and Chico, serving these towns and Oroville from its Marysville plant.

This company also constructed a 60-mile, 8-inch line from Fresno to Merced, to be leased to and operated by San Joaquin Light & Power Corp. of Fresno. The line was completed by the first of April of this year, and brings "natural" to Merced, a changeover having been completed early in the month. Madera is also served from this line. From Fresno, a 12-inch line extends six miles to the Herndon Power Plant of the San Joaquin Light & Power Corp., now under construction at Herndon.

During 1930 and the first three months of 1931 P. G. and E.'s expenditures for gas transmission line construction amounted to more than $5,800,000.

Standard-Pacific Gas Line, Inc., was formed by Pacific Gas and Electric Co. and Standard Oil Co. of California, these two companies joining capital in the construction of a natural gas transmission line from the Kettleman Hills field to Richmond. The line was completed in 1930, comprising 120 miles of 26-inch, 24.8 miles of 24-inch, 9.5 miles of 20-inch and 43.1 miles of 22-inch pipe. Gas transmitted from the fields through this line serves industrial and domestic markets in Pacific Gas and Electric Co.'s northern California territory.

Southern California Gas Co.: Early in 1930, Southern California Gas Co., Los Angeles, Calif., announced plans for construction of a 70-mile line from Kettleman Hills fields to Los Angeles, increasing the supply in the Los Angeles area to 150,000,000 cubic feet daily.

Two sections of this line, one 10-mile, and one 9-mile are constructed of 26-inch pipe, with the balance, totaling 87 miles, of 22-inch. Cost of the line was approximately $3,000,000. The 40-mile section over the Tehachapi Mountains represented very hard going, route of the line taking it through some of California's roughest terrain. The carrier was announced ready for service on November 1.

Southern Counties Gas Co.: A 39-mile, 16-inch welded line was laid by Southern Counties Gas Co., Los Angeles, Calif., from the Elwood field to Ventura, Calif., completion being announced around the first of January. Construction of this line cost $684,-000. Goleta, the beginning point of the line, is located about 6 miles north of Santa Barbara, near the Elwood field from which the gas supply is drawn.

Southern Fuel Co., of Los Angeles, newly organized by the Southern California Gas Co. and Southern California Edison Co., Ltd., began construction operations on a 210-mile, 26-inch carrier from Kettleman Hills fields to Los Angeles and Long Beach. The line will supplement the domestic and industrial fuel requirements of the Los Angeles basin, as well as supplying fuel for the generation of power in the Edison company's steam plant at Long Beach. (A description of this plant appears on Page 42 of this issue.)

Route of the line will take it through the Tehachapi Mountains, paralleling the Southern California Gas Co.'s 22-inch carrier. Construction difficulties are anticipated in the mountainous regions, and in the metropolitan area of Los Angeles, where the large diameter of the pipe will give rise to unusual problems.

Capacity of the line will be about one-third of the total amount of gas handled in the Los Angeles district at present.

MANUFACTURED GAS

Construction of transmission lines for extending manufactured gas service to towns located at some distance from the central plant has gone on apace during the past year, with 30 towns on the Pacific coast supplied in this manner.

Portland Gas & Coke Co. of Portland, Ore., constructed a line, 28 miles of which were 6-inch and 37 miles, 4-inch, to Corvallis, from Salem, the project representing an expenditure of $249,770. From Tualatin to Newberg 12 miles of 6-inch pipe line was constructed, and from Gervais to Silverton, 12 miles of 4-inch pipe was laid, the last two developments costing $66,750.

Seattle Gas Co., Seattle, Wash., took a $63,000, 10-mile line to Kent, beginning service in that town on March 9.

Washington Gas & Electric Co., headquartered at Tacoma, constructed a 13-mile extension from its Puyallup line to serve Sumner and Auburn.

San Diego Consolidated Gas and Electric Co., San Diego, Calif., completed a 26-mile line connecting its San Diego system with the plant owned by the company at Oceanside. Seven towns will be served through this carrier, two of which have had service previously from plants in their own locale. The project was brought to completion at a cost of $190,000, including compressor station facilities.

A line is also under consideration by the company from Chula Vista to San Ysidro, on the Mexican border, this project calling for an outlay of $50,000.

Make More Money with

RAY-GLO is different
in principle, efficiency and CERTAINTY.

Nothing left to chance—
or accident. No variable controls. FIXED MIX.

Hotter flame obtained
by unique burner with patented features.

90% of all air
needed for COMPLETE combustion injected BEFORE combustion begins!

Patented backwall
makes complete combustion POSITIVE—no fumes or odors.

Air-Cooling features
increase the high heat efficiency of burner by THIRTY per cent.

High heat intensity
promoted by special features of radiants and backwall.

Vitalite radiants
emit vital Ultra-Violet rays of sunlight!

No vent required—
90% are operated without.

No need for "service"
whether gas pressure goes way up, or down to a half-ounce!

Manufacturing methods
assure as perfect performance in home as in laboratory tests!

Fully guaranteed
by makers, praised by thousands of users.

Outstanding values!

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Radiant Gas Heaters

The Radiant Heaters with the "FIXED" Mix

Unique Ray-Glo construction never needs adjusting - - STOPS that "service calls" expense!

Besides, a special feature makes installation so quick and easy that you are saved real dollars on ordinary labor costs!

Ray-Glo will put your radiant heater business on the right side of your ledger—and keep it there!

THE "COLONIAL"

THE "TEXAN"

There's a Ray-Glo model for every place, and every purse—two of the twenty are pictured. Values challenge comparison. We furnish effective sales co-operation. Write for the Ray-Glo story!

RAY-GLO CORPORATION

Athens, Ohio

The Civic Auditorium, San Francisco, will house a gas appliance and equipment exposition in connection with the Pacific Coast Gas Association annual session, August 31-September 5.

P. C. G. A. Sounding Convention Call

THE huge Civic Auditorium of San Francisco will soon house the most complete and most modern exposition of gas appliances and accessories that the Pacific Coast has ever seen—held August 31 to September 5 in conjunction with the annual convention of the Pacific Coast Gas Association during the same dates.

This exhibit will be a fitting culmination to a year of activity marked by intensive advertising and publicity on the part of the Pacific Coast Gas Association under the leadership of President R. E. Fisher.

The Pacific Gas and Electric Co., of which Mr. Fisher is vice-president in charge of public relations and sales, is now engaged in one of the most intensive sales campaigns in the history of the industry. It is less than a year ago that the P.G. and E. brought natural gas to its system from California's famed Kettleman Hills field.

The Natural Gas Exposition will be designed to serve a dual purpose. Serving as a source of information and inspiration to members of the Pacific Coast Gas Association, it will also educate hundreds of thousands of gas consumers in northern California to the modern uses of gas in modern gas appliances.

The major expense of the Exposition will be borne by the Pacific Gas and Electric Co., and invitations have been sent out to manufacturers of gas appliances and equipment soliciting their participation at a moderate cost. Despite the tremendous size of the auditorium, only 88 booths will be available to manufacturers, and this space is already being rapidly assigned to applicants. The cost to exhibitors of 80c per square foot, with 20 per cent additional for corner locations, is said to be the lowest charge ever made to commercial exhibitors in this structure, which has been the scene of thousands of expositions.

The two smaller assembly halls which flank the main auditorium will be devoted to a daily cooking school and to the convention sessions.

Billboards, newspaper advertising, publicity and contests are all to be employed in stimulating the interest of the million and a half population that is centered around the San Francisco Bay Metropolitan Area.

Manufacturers of gas appliances will be keenly interested in the sales possibility of this territory, as revealed by a recent house-to-house survey made over the Pacific Gas and Electric Co.'s system. The survey indicated that:

45 per cent of the homes have no cabinet gas ranges.

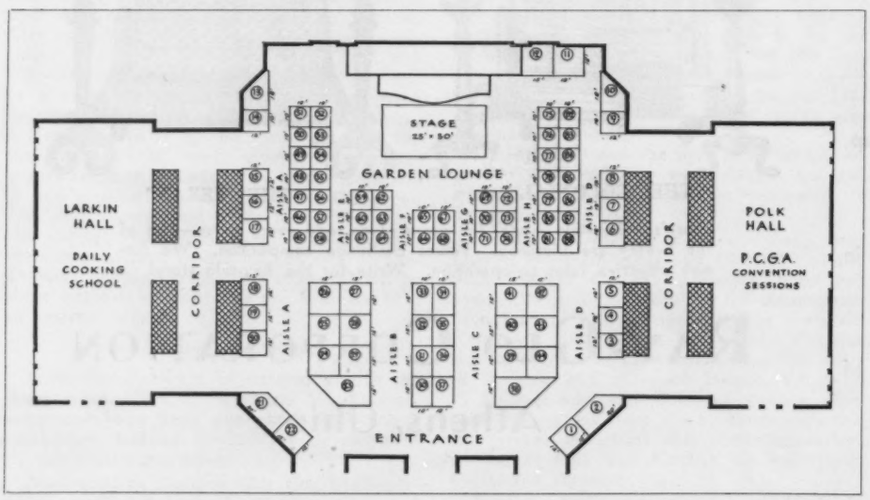
70 per cent of the homes have no automatic water heaters.

95 per cent of the homes have no gas-fired central heating.

71 per cent of the homes have no gas heating of any kind.

The 38th Annual Convention of the Pacific Coast Gas Association will bring to San Francisco, the executives and department heads of every gas company from Vancouver to San Diego. The companies represented in P.C.G.A. membership serve a million and a half consumers, gas sales totalling over 130,000,000,000 cubic feet per year.

Detailed arrangements for the Convention are in the hands of John F. Coghlan, second vice-president of the Pacific Gas and Electric Co., as general convention chairman. H. M. Crawford, general sales manager of the P. G. and E. is chairman of the Exposition Committee, with George P. Egleston, general manager of the H. R. Basford Co., director of exhibits. Al C. Joy, manager of the publicity and advertising department of the Pacific Gas and Electric Co., will direct the campaign of advertising and publicity which will sell the show to the public.



Floor plan showing exhibit spaces in Civic Auditorium.

1931 Calendar

May

Natural Gas Department, A.G.A.—Annual Convention, Memphis, Tenn., May 11-14, 1931.

Joint Production and Chemical Conference, A.G.A.—Benjamin Franklin Hotel, Philadelphia, Pa. May 20-22, 1931.

Southern California Meter Association—Los Angeles, Calif., May 28, 1931.

June

Canadian Gas Association—24th Annual Convention, Windsor Hotel, Montreal, Province of Quebec, Canada, June 4-5, 1931.

Pacific Coast Gas Association, Northwest Regional Conference—Tacoma, Wash., June 11-12, 1931.

American Gas Association, Domestic Appliance Course—Testing Laboratory, Cleveland, Ohio, June 15-20, 1931.

September

Pacific Coast Gas Association—Annual Convention, San Francisco, Calif., August 31 to September 5, 1931.

October

American Gas Association—13th Annual Convention, Atlantic City, week of October 12, 1931.

BURNERS

FOR EVERY POSSIBLE COMBUSTION REQUIREMENT

PUBLIC UTILITY *CORPORATIONS* *are invited to bring us their problems in Combustion Engineering*

NEMEC BURNERS are offered in the largest variety of types of any make in the world.

NEMEC BURNERS are outselling all other makes wherever introduced, including San Francisco.

NEMEC BURNERS enable utilities to hold the load against competitive fuels.

NEMEC BURNERS are simple in construction, easy to install and operate.

NEMEC BURNERS include "Bunsens" Multiple-Jets, vertical type, swing type, and combination oil and gas burners.

NEMEC BURNERS, radiant type, are used for converting domestic furnaces and heating boilers.

NEMEC BURNERS are equipped with automatic draft control.

NEMEC BURNERS have exclusive features based on sound engineering principles.

NEMEC BURNERS are proven before offered to the trade. They are the result of 15 years experience with natural gas combustion.

NEMEC COMBUSTION EQUIPMENT includes only specialties of proven merit.

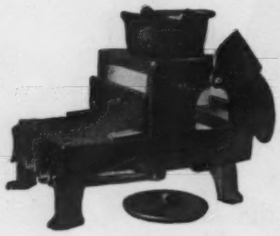
NEMEC ENGINEERS are constantly engaged in research work in a practical way. They understand coal, oil and other fuels and have helped many gas companies to successfully compete against these fuels.

NEMEC BURNERS are standard equipment with some of the world's largest corporations.

NEMEC COMBUSTION ENGINEERS
WHITTIER - - - CALIFORNIA

NEMEC *combustion* EQUIPMENT

Combination Bench Furnace Economy and the JOHNSON No. 118



The No. 118 is a perfect model of modern efficiency and economy. Compactness saves space; and in this small space it will perform three important heating operations. Heats soldering coppers, branding irons, etc., melts soft metals and heat-treats small pieces. All this accomplished efficiently without a blower. Write for details and price list.

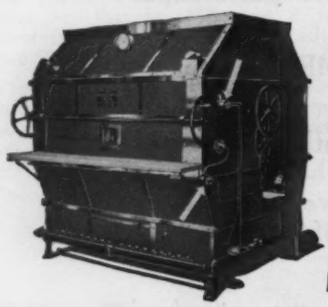
A Combination Torch and Melting Pot JOHNSON No. 8

A practical and inexpensive unit easily adapted to perform a number of heating jobs in shops and laboratories. The burner is supported by a hand screw attachment and may be adjusted to any angle or removed and used as a hand torch. You'll be interested in the complete details —write now.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

Pacific Coast Representative—C. B. BABCOCK CO.
135 Bluxome St., San Francisco, Calif.

Two New Features of the McDonald Made Meek Reel Oven— A Real Gas Business Builder



The McDonald-Made MEEK REEL OVEN has been a favorite with bakers for twenty-five years. Now it has TWO NEW IMPROVEMENTS that make it even a better buy for the baker. All gas burning McDonald Made Reel Ovens are equipped with AUTOMATIC HEAT CONTROL and automatic INTERIOR LIGHTING.

There are two new sales points for your use in increasing bakery consumption of gas. SWITCH THE BAKERS IN YOUR TOWN TO GAS with this modern gas burning oven. Send for our new catalog for complete details.

BRUCE McDONALD COMPANY
Kansas City, Mo.

Also Manufacturers of

RED DEVIL OVENS

(Branch office in Los Angeles, Cal.)

BRUCE McDONALD CO.
2019 Washington St.
Kansas City, Mo.

Please send me your new 1931 Catalogue. I am interested in switching bakers in my community to a gas oven.

Name.....

Firm Name.....

City.....State.....

H. L. Farrar to Manage Pacific Public Service Subsidiaries

OFFICIALS of Standard Management and Operating Corp., San Francisco, have just announced the apointment of H. L. Farrar to take charge of operations for all gas and electric utilities subsidiary to Pacific Public Service Co., and operated by Standard Management and Operating Corp., including Coast Counties Gas and Electric Co., Natural Gas Corp's. of Calif., Wash., and Ore., and affiliated organizations.

H. L. Farrar

Mr. Farrar comes from the Western United Gas and Electric Co., an Insull-operated property at Aurora, Ill., where he has been general superintendent of gas operations for the past 4 years.

Previous to that time he was active in the development of the southern Illinois district of this company. His experience in this territory included manufactured and natural gas, electricity, water and coal mining problems. One of the first companies to attempt the long distance transmission of manufactured gas under high pressure was the Western United Gas and Electric Co., the work being carried on under the direction of Mr. Farrar.

Mr. Farrar's activities with the Standard Management and Operating Corp. will at the present time be devoted to the further development of gas properties operated by this company throughout the states of California, Oregon and Washington.

At the present time he is making a tour of the butane or "Bu-gas" properties in the Pacific Northwest, accompanied by Executive Vice-President, R. E. Aitcheson and Manager of Sales T. E. Bartlett of the three Natural Gas corporations.

He will also spend some time in the properties operated by Coast Counties Gas and Electric Co., of Santa Cruz, Calif., and Westside Natural Gas Co., Taft, Calif.

Merced Served; Madera Scheduled for Immediate Service

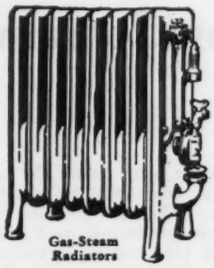
Merced, Calif., received its first natural gas early in April through the recently completed 64-mile transmission line constructed at a cost of $670,000 by Pacific Gas and Electric Co., and leased to San Joaquin Light & Power Corp., of Fresno, now operating the line and distributing the gas.

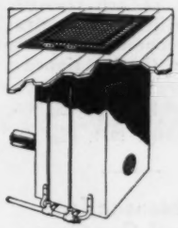
Plans for immediate connection of the Madera gas lines to this system have been announced by A. Emory Wishon, president of the company.

Natural gas for Madera follows the sale of the local gas service facilities to the Pacific Gas and Electric Co., San Francisco, which will lease them to San Joaquin Light and Power Corp. Southern California Gas Co., Los Angeles, former owner of the Madera system, is also selling its facilities in Turlock to the P.G. and E., formal application for authorization of the sale having been filed with the California Railroad Commission.

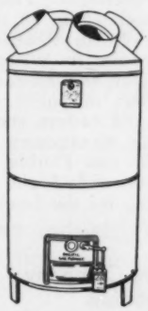
New Service at Eureka, Calif.

Pacific Gas and Electric Co., San Francisco, Calif., plans to install 400 new services at Eureka, Calif.


Gas-Steam Radiators


Pipeless Floor Furnaces

Dual Pipeless Furnaces


The New Perfected Pacific Gas Unit Furnaces

Recessed Wall Heaters

Radiant Fireplace Heater

PACIFIC...

The Right Gas Appliance for Every Gas-Heating Job

THERE'S A LOT of satisfaction, both for you and your customers, in handling a line that is COMPLETE. No matter what kind of job comes up, you can say: "Here's the ***right*** appliance to fit the need."

A Pacific Gas Agency provides every gas appliance you need, from a single source—the largest and oldest gas-heating organization in the West. You understand one line better than the products of many firms. There is full centralized responsibility. Your guarantee means more because you thoroughly understand the Pacific Guarantee and are working closely with us.

Look over the items briefly described here, then write for full details of our attractive dealer proposition.

Pacific 5-Column Gas-Steam Radiators, Vented and Unvented

The Pacific Gas-Steam Heating System can consist of one unit or a thousand. Each is independent of all others, supplying comfortable steam heat at the turn of a valve. Beautiful 5-column radiators. Instant appeal. Used in finest homes, and institutions. Made in both vented and unvented types.

Pacific Gas Radiators

Use no water. Simple, compact, durable, quick-acting, and economical. Handsome in appearance. The pressed-metal type is for homes, apartments, etc., and the heavy cast iron type is for larger buildings.

Pacific Gas-Unit Furnaces

The perfect warm air heating system. Use as many units as required to provide number of outlets desired. Electric or manual control, or supplied with automatic heat regulator. Long-lasting. Trouble-proof.

Pacific Floor Furnaces

Scientific design, with sealed combustion chamber and outside vent. Heavy cast iron heating dome assures perfect uninterrupted heating service for many years.

Pacific Fireplace Radiant Heaters

Equipped with Pacific New-Feature Burner, which provides complete combustion with any type gas, without need of adjustment. Many sizes, styles and finishes.

Pacific Automatic Water Heaters

Here's the most salable line of quality water heaters you've ever seen. Both instantaneous and automatic storage types. The latter have center heating flues and outside shell of boiler is also used as heating surface. Efficient, well-insulated, economical, with positive thermostat control. A size and type for every purpose.

Pacific Gas Radiator

Gas Heating **Company** *Headquarters*

Roseberry and Walter Sts., Huntington Park, Calif.

Write us about the attractive Pacific Gas Agency proposition for your territory

SUBSTANTIAL
REDUCTION
ON VENTED
CLOW GASTEAM
RADIATORS

WRITE for
NEW PRICES

JAMES B. CLOW & SONS
201-299 N. Talman Avenue, Chicago

World's Largest Industrial Gas Consumer

(Continued from Page 44)

Natural gas fuel used by the Long Beach steam plant has shown a steady increase the past three years. Graph No. 1 shows gas consumption at the Long Beach plant for the last four-year period. Requirements for 1931 are estimated at 16,600,000,000 cubic feet.

Year	Cubic Feet
1922	616,333,300
1923	2,253,317,200
1924	5,268,550,700
1925	4,345,258,750
1926	3,355,304,000
1927	2,931,866,300
1928	7,942,416,800
1929	15,637,795,600
1930	13,827,605,450

Future Program

In the immediate future no further hydro-electric developments are contemplated on the Edison system, and steam plant capacity only will be developed. Construction work has already been started on the third 100,000 kw. unit in Long Beach No. 3 plant, which should be completed by 1933, and additional 100,000 kw. units will be added at about two-year intervals thereafter. With this anticipated increase in steam power output the fuel requirements will increase enormously.

The supply of natural gas in the Southern Basin fields is decreasing rapidly, and it is estimated that in the near future the supply of gas from these fields will be insufficient to meet demands. The San Joaquin Valley fields are at present producing more gas than there is a market for, and conservative development of these fields assures long life of supply. Southern Fuel Co.* has commenced construction of a 26-inch transmisison line from Kettleman Hills to Long Beach, which is scheduled for operation by the end of 1931. The Edison Co. has signed a contract with Southern Fuel Co. for a large supply of natural gas over a period of years.

**Western Gas*, February, 1931, Page 51.

E. A. Olsen to Manage for Oklahoma Natural Gas Corp.

E. A. Olsen, vice-president of Pacific Public Service Co., of San Francisco, Calif., and its subsidiaries, has announced his resignation from that company to take over the executive management of the Oklahoma Natural Gas Corp., headquartered in Tulsa.

Mr. Olsen expected to arrive in Tulsa the first of May and will direct the operations of the company which has distribution systems in more than 50 cities of the state, including Tulsa, Oklahoma City and Muskogee.

Mr. Olsen came to California from Florida when A. E. Fitkin and Co. purchased the Coast Counties Gas and Electric Co. system from S. Waldo Coleman. Subsequently Pacific Public Service Co. was organized, with Mr. Olsen as vice-president. Following the war he became associated in an engineering capacity with the North American-owned public utility companies in Wisconsin. He lated joined with Day and Zimmerman, engineers and operators of public utilities in Virginia, Georgia and eastern states. Later Mr. Olsen had the management of public utilities in Georgia and Florida, including the Georgia Power and Light and The Florida Power Corp., for the Insull interests.

Sharples Specialty Company Announces Promotions

The Sharples Specialty Co., headquartered at Philadelphia, Pa., announces the appointment of James H. Wilcox as general manager of the company's Pacific Coast branches. Mr. Wilcox, who joined the company in 1924, has been manager of the Sharples branch in Los Angeles for the past 5 years.

Mr. Wilcox takes the place of Weaver L. Marston, who returns to the main office of the Sharples Specialty Co., at Philadelphia to become sales manager for the entire company. Mr. Marston's connection with the company dates from 1926. Previous to assuming charge of the Pacific Coast territory he was assistant sales manager at the main office in Philadelphia, to which he is now returning.

Thomas J. Griffin, formerly assistant manager of the Pittsburgh, Pa., branch, becomes manager of the Los Angeles branch.

The Sharples Specialty Co. manufactures the Sharples "Super Centrifuge"—a centrifugal oil purifier used in natural gasoline plants and compressor stations for purifying the lubricating oil in the compressors.

GROBLE
REGULATORS & GOVERNORS

Complete Line of Regulators for

Natural, Manufactured, Butane and Propane Gas

Pacific Coast Representative,

T. G. ARROWSMITH COMPANY,

661 Howard Street San Francisco, Calif.

Phone Garfield 8419

GROBLE GAS REGULATOR COMPANY

Office and Factory: Anderson, Indiana

T A P P A N

Supremacy

is not a newly-won achievement, but an old and accepted standing in the eyes of gas appliance men and the public alike. No other gas range combines so many outstanding superiorities into such a perfect whole—the TAPPAN Insulated Oven gas range.

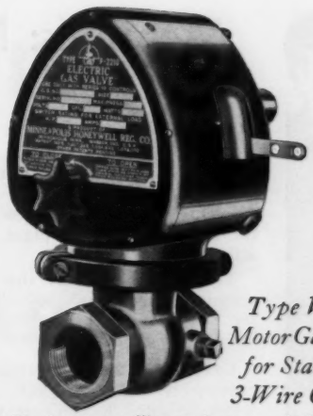
H. R. Basford Co.
665 Howard St.
San Francisco

H. R. Mayer
1001 E. 1st St.
Los Angeles

F. W. Schwab
2512 N. Stevens
Tacoma

Your industrial sales department's

strong right arm

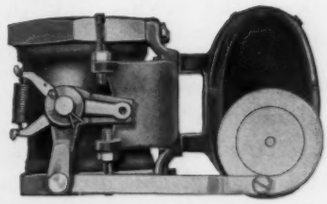


Type V30-1 Motor Gas Valve for Standard 3-Wire Control

Used as controlling and automatic final safety shut-off valve. Can be opened manually. Low current and low voltage control. Standard pyrometer, indicating and recording pressure thermometer, or Minneapolis-Honeywell "Series 20" controllers operate these motor valves.

Type V-20 & V-21 Motor Operated Globe Valves

Applicable to industrial high pressure inspirating burners and ordinary flow regulators. Butterfly valve can be attached for two-pipe combustion systems.



Type M-20 and M-21 Motor Operated Butterfly Valves — Function with industrial low pressure inspirating gas burners.

This nationwide engineering and service organization offers you its experience in the automatic control of industrial gas applications.

Closing industrial prospects and increasing your load among present users is a job you can do with greater ease when you have complete information about the many different types of automatic controls needed for industrial gas applications.

Minneapolis-Honeywell engineers, located in every large population center, are equipped and ready to serve you. They offer you a varied line of automatic controls for industrial processes. They offer you the benefit of their field experience in such widely different industries as metal, food, chemical and textile. They offer you thoroughly organized service.

Your industrial sales department, working in a field where every job is different, will find the Minneapolis-Honeywell nationwide engineering organization a strong right arm ready and able to help you increase your industrial load. Minneapolis-Honeywell Regulator Company.

CALIFORNIA BRANCH
557 Market Street, San Francisco, California
DISTRIBUTORS
Portland, Seattle, Salt Lake City, Denver

MINNEAPOLIS-HONEYWELL

Automatic Heat Controls

IT'S
GOOD BUSINESS

to stop where
Business is Good!

2,500 rooms. A radio, tub, shower, circulating ice water, Servidor in every one of them. Extra value!

Every room an *outside* room —and 85% of them priced at $3.50 to $5.00. Extra value!

116 new sample rooms. 4 popular price restaurants, including a "speed counter" Coffee Shop—with food that is the talk of the town. Extra value!

A location in the heart of midtown Manhattan "next door to everything". Private tunnel to the Pennsylvania Station. B. & O. Motor Coach connections, too. Extra value!

The overwhelming success of the Hotel New Yorker is not built upon low rates alone; it is built upon BIGGER AND BETTER VALUE. Come and get it.

HOTEL
NEW YORKER

NEW YORK'S MOST POPULAR HOTEL
34th Street, at 8th Avenue, New York
RALPH HITZ, MANAGING DIRECTOR
Chicago Office: 77 West Washington Street

Memphis: Natural Gas Mecca in May

(Continued from Page 35)

mates two and one-half times as much as it was before natural gas was introduced. This is exclusive of the gas used in the boilers of the company's power plant, which uses gas altogether for fuel.

This company feels that it has done a reasonably good job in selling natural gas for commercial, industrial and domestic househeating purposes.

Commercial and Industrial Activity: The commercial heating and industrial rates were designed to compete with the fuels in general use in the city. They are of the more advanced type giving the minimum rate to the customer having the best load factor. This was accomplished by rate schedules of the demand plus commodity type.

With its lowered rates effective, the company organized engineering and sales forces for surveying the requirements of customers in selling the new fuel.

This organization was divided into three groups, one group handling domestic and small commercial appliances, another handling househeating equipment, while the third group takes care of all large heating and industrial installations. Conversion burners for all types of heating and industrial plants comprised the equipment to be sold, but particular emphasis was placed upon the service which we had to offer.

The task of adapting old and inefficient equipment to the use of natural gas was not nearly so difficult as might be expected. Due to the wide use of soft coal for all purposes, the chimneys, smoke-stacks and other facilities for handling products of combustion from the furnaces were of sufficient capacity to allow improved baffling of the gases without causing trouble from low draft.

When a survey of the requirements was made, all possible points were studied with a view to giving the customer the most complete and efficient service possible. The most readily apparent value of gas was the fact that it required no storage room. Often before the survey was completed, plans had been drawn for converting the coal storage room into a tool and storeroom.

The next point usually raised was the value of automatic control and the ease with which it could be applied to natural gas fuel. This usually led to a discussion of the labor-saving involved both for handling the fuel and cleaning the premises, the furnaces and the boilers themselves. These are the points where the values of gas are most outstanding, and a study of their value usually results in the question of "how much of this superior fuel do I need?" The equipment using gas can be operated at a maximum capacity all the time and at a maximum efficiency, tests being made to insure absolutely correct operation. A continuous check-up on operation costs is always available, as the plant operators are taught to read the meters and any increase is noted and the causes corrected immediately. This point is often the means of effecting economies in other departments through better scheduling of operations.

We find economizers and other forms of heat-saving equipment are readily operated when using gas fuel, as the products of combustion are free from corrosive gases. After securing all the information available and ascertaining the requirements of our customer, the specialists make their recommendations both as to the equipment and the operation of the plant.

Practically all the office buildings and large downtown business houses generally have adopted gas for fuel. Other large properties such as hospitals and apartments are also enthusiastic users of gas. Almost all the hospitals of the city now have gas-fired boilers.

In an industrial way we have been successful in securing the adoption of gas as a fuel to a large degree. There are in Memphis, however, many mills and wood-working plants which have sufficient refuse fuel to supply their fuel needs. In several of the large plants of this type gas is being used as a stand-by fuel, in which service it has no equal, inasmuch as heat is almost instantaneous at the turn of a valve. Indeed this makes gas the ideal fuel for a great range of industrial and commercial applications.

Domestic Househeating Activity: The domestic use of gas, for househeating, has been aggressively pushed. Most of the company's advertising has been designed to promote this use of gas, the field of consumers being more numerous.

Prior to the introduction of natural gas, a survey was made of residential heating systems and a list of nearly 10,000 addresses secured where central heating plants were installed. This list was made the basis for direct mail campaigns used in our effort to sell conversion installations. To date approximately 2400, or nearly 25 per cent of the original list have been sold.

Supplementing the newspaper advertising on domestic househeating, folders were mailed to the list referred to above, particularly during the spring, summer and early fall seasons, our experience being that home owners are more inclined to contract for installations during the warm months than during the heating season. In fact it has been our experience that with the first severely cold weather domestic heating equipment sales fall off perceptibly; and, throughout the winter season there is greater difficulty in making sales than during the warm months.

Our sales of domestic installations for heating systems have been confined to conversion burners, we having concentrated on two of the approved and popular makes. We have not sold gas designed boilers, though several of the leading manufacturers have distributors or dealers in Memphis and our company has sought to cooperate with them, and heating contractors, in promoting sales of heating equipment of this type for all new residences, and replacements. In fact our company employs a man who gives his full time to visiting architects, realtors and subdivision promoters, as well as calling upon heating contractors, with a view to stimulating sales of this type of equipment, and the use of natural gas as fuel.

In addition to the heating plant equipment, gas heating appliances of the circulator, radiant-type and room heater type have been generally adopted in Memphis. While we have no accurate figures, our estimate which we believe to be conservative is that approximately 4500 homes of the city depend upon gas-burning appliances of these types for their principal heating. Such appliances are sold by all the hardware deal-

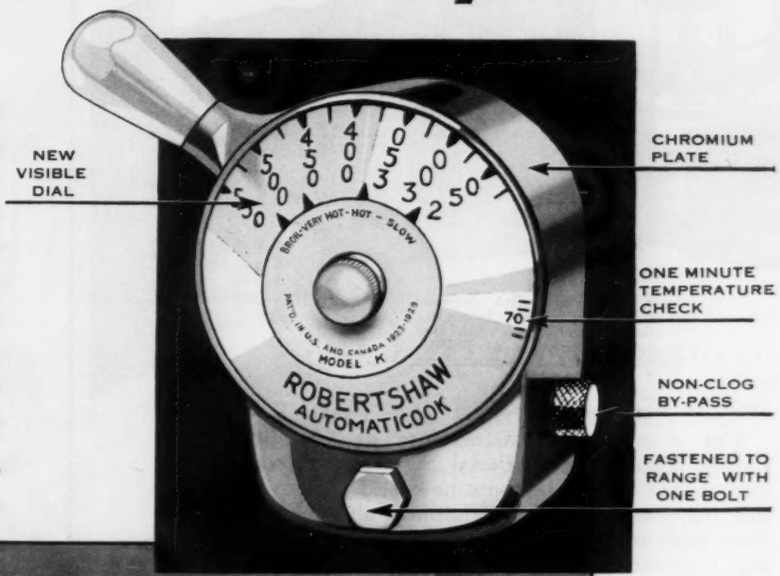
» Creating NEW customers for you

BY CONSISTENT ADVERTISING in the foremost national publications, American housewives all over the country have been educated to *insist* on having a gas range that is Robertshaw equipped. And that means a *new* range, for the Robertshaw cannot be sold separately. More than 140 popular brands are now made with the Robertshaw as standard equipment.

It's smart selling strategy for you to demonstrate the Robertshaw as often as you can. Show the housewife how this simple, trouble-proof, neat appearing device gives her automatic and controlled cooking. Make her realize what it means to get away from the kitchen for hours and hours of new freedom, new sociability.

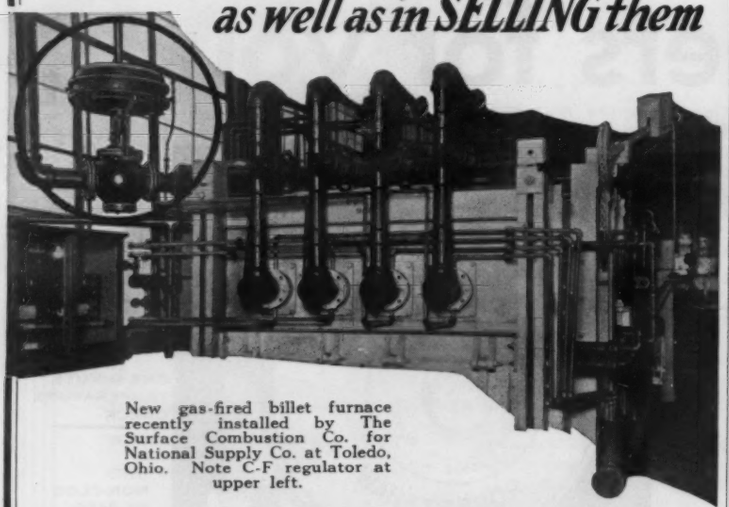
Keep in touch with the great advertising drive. See the campaign this spring. Be sure that your salesmen and service men also know the manifest advantages of Robertshaw cooking. Just send us their names and we will place the Robertshaw story throughout your organization.

ROBERTSHAW
THERMOSTAT COMPANY
YOUNGWOOD, PENNA.



ROBERTSHAW
AutomatiCook

They Believe in *USING* C-F Regulators *as well as in SELLING them*



New gas-fired billet furnace recently installed by The Surface Combustion Co. for National Supply Co. at Toledo, Ohio. Note C-F regulator at upper left.

For many years distributors of Chaplin-Fulton Regulators, National Supply Company knows that no matter how new and improved the process might be, Chaplin-Fulton keeps pace with industrial developments by supplying regulators that will meet new demands. They sell C-F and they use C-F for their own regulation requirements.

The Chaplin-Fulton Mfg. Co.

Organized 1884—Oldest Builders of Gas Regulators in the Country. Built in all Sizes From 1 Inch to 24 Inches; For All Service. 1 oz. up to 2,000 lbs. Pressure to Square Inch.

28-40 Penn Avenue **Pittsburgh, Pa.**

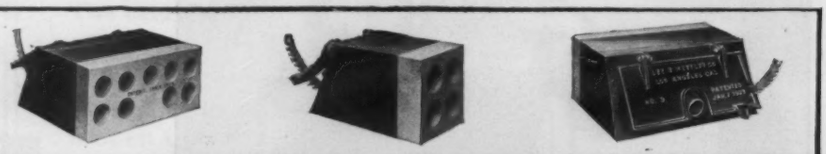
REPRESENTATIVES:

WESTCOTT & GREIS, Inc. Sales and Service
Dallas — Los Angeles — Tulsa

JNO. W. CRAWFORD Sales Engineer
1855 Industrial Street Los Angeles

PARSONS ENGINEERING CO.
Los Angeles, Calif. San Francisco, Calif.

Or Any Jobber



Mettler Entrained Combustion Gas Burners

FOR ALL Purposes Kinds of gas Pressures

LEE B. METTLER. CO.

406 S. Main St. Los Angeles Cal.

ers, department stores, and numerous gas appliance dealers.

Sales Organization: In organizing our sales department, a separate group of salesmen is employed for conversion burners. At present 12 men and a supervisor constitute this particular group.

Other househeating appliances are sold by the salesmen, who also sell ranges, water heaters and other gas-burning equipment.

Under our system of directing sales, each salesman is allotted certain territory within which he is paid a commission on all sales, whether made through his direct efforts, or on the company's sales floor, if prospect card is on file.

We have at present about 22 gas salesmen for our city, in which we have approximately 38,000 active gas meters.

Natural gas as a fuel has, we believe, continually gained in favor in the minds of Memphis people. Our consumption has not only increased about two and one-half times since its introduction, but last year's records, in face of depressed conditions, showed an increased number of meters. Like all cities where natural gas has been introduced, we have met opposition of dealers in crude fuels, but despite this opposition gas sales are steadily gaining and, in our judgment, will continue to show satisfactory increase.

Public Utilities Advertising Association to Meet June 14-16

The annual convention of the Public Utilities Advertising Association will be held in New York from June 14 to 16, according to an announcement made by Irving M. Tuteur, of Chicago, Ill., president of the association.

It is expected that nearly 200 public utility advertising men from all sections of the country will attend the convention, which will be held in conjunction with the annual gathering of the American Federation of Advertising, of which the public utility group is a department.

J. S. S. Richardson, director of information, Joint Committee of National Utility Associations, is chairman of the program committee, and Keith Clevenger, director of publicity and advertising, American Gas Association, is chairman of the committee on entertainment and arrangements.

A feature of the convention will be the awarding of prizes for the best public utility advertisements appearing in newspapers during 1930, Mr. Tuteur said. Prizes will also be given for direct mail, billboards, and poster advertising.

Newcastle, Upton and Osage Being Considered for Service

Newcastle, Wyo., about 50 miles southwest of Rapid City, So. Dak., may have natural gas in the near future from lines of the Montana-Dakota Power Co. Upton and Osage, Wyo., are also being considered as possible markets, according to recent reports from the Wyoming press.

"Roberts Junior" Is Announced by Roberts-Gordon Appliance Corp.

The April issue of "The Load Builder," published by Roberts-Gordon Appliance Corp. of Buffalo, N. Y., announces the production of the "Roberts Junior," planned and built as a companion to the Roberts Standard burner. The "Junior" is designed to meet the demand for a smaller conversion burner.

Plan your Sales Activities NOW!

Send for this book

NOW is the time to go after gas home heating sales. The selling season is on. Plan your sales campaign with the aid of this new Roberts-Gordon Book. It tells how to make the most of your sales opportunity.

Send for this book today.

ROBERTS
CONTROLLED
GAS HEATING UNIT

ROBERTS-GORDON
APPLIANCE CORPORATION
CURTISS BLDG. BUFFALO, N. Y.

Trade Mark

ROBERTS-GORDON
APPLIANCE CORPORATION
Curtiss Building
Buffalo, N. Y.

Gentlemen:

You may send us without obligation a copy of your new book entitled "Selling the Home Heating Market."

Signed _____

Name of Company _____

Street Address _____

City _____ *State* _____

Industrial Gas BOILERS

Price Revision Downward on Tubular Boilers

The New H. E. Flueless Industrial Gas Boiler is now ready in three sizes.

One H.P. Two H.P. Three H.P.

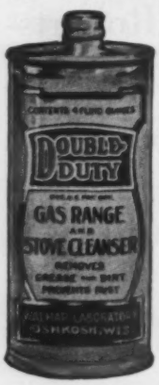
"No Tubes But Equal Efficiency"

P. M. LATTNER MANUFACTURING CO.

Factory
516 12th Avenue
Cedar Rapids, Iowa

Warehouse Distributor
2646 South Hill Street
Los Angeles, California

The Heart of Any Home Is the Kitchen Gas Stove
Keep It Bright and Clean By the Use of



Removes Grease

DOUBLE DUTY
REG. U.S. PAT. OFF.

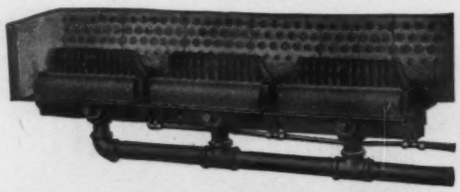
Prevents Rust

GAS RANGE & STOVE CLEANSER

WALMAR LABORATORY Oshkosh, Wisconsin

Western Distributor
C. B. BABCOCK CO., San Francisco, Los Angeles

R. M. C. Gas Burner



Durable Safe Economical

ROTARY MANUFACTURING CO.

5720 Long Beach Avenue Los Angeles, California

Reduced Rates Announced for Phoenix Area

NEW schedules for gas and electric rates to become effective May 1 have been announced by the Central Arizona Light and Power Co., Phoenix, Ariz., and approved by the Arizona Corporation Commission. These rates will affect consumers in Phoenix and several other towns in the Salt River Valley.

The new rates give reductions to practically all classifications of consumers including residential, commercial, power and gas and will result in an annual reduction of over $128,000.00. Existing rates are to be retained as optional to the consumer. This is the second general rate reduction announced by the company in the past 5 years and during this time there have been 44 reductions in individual schedules affecting local consumers.

This rate reduction includes a flat charge per month plus a charge for the gas used. The new rates are based on the therm instead of the cubic foot as the basis for billing.

The new gas rate as applied to Phoenix is: 90c per month, flat charge; 30c per therm for the 1st 25; 26c per therm for the next 25; 22c per therm for the next 450; 18c per therm for excess.

The combination domestic service and house-heating rate is the same as above with the 26c block eliminated so that house-heating can be secured at the 22c block.

The old Phoenix gas rate which remains optional to the consumer is: $1.00 per month minimum; $1.80 per M.c.f. for first 2 M.c.f.; $1.60 per M.c.f. the next 3 M.c.f.; $1.40 per M.c.f. the next 5 M.c.f.; $1.20 per M.c.f. for excess.

The old high pressure gas rate which has been effective north of Phoenix has been cancelled by the Commission.

Guthrie Votes Franchise to Western Service Corp.

Citizens of Guthrie, Okla., late in March granted a gas franchise to the Western Service Corp., Oklahoma City, and approved cancellation of a $225,000 city bond issue for a municipally owned natural gas system, originally voted June 16, 1930.

The 25-year franchise provides for domestic gas at a maximum of 45 cents per 1,000 cubic feet and a free supply of 2,000,000 cubic feet each year for city consumption. It also gives the city 3 per cent of the gross receipts on the first 100,000 cubic feet of gas to each consumer each month, and offers an industrial rate as low as 11 cents for the city school system.

Western Service Corp., of which Earl R. Ernsberger is president and general manager, plans to secure its supply for Guthrie from the Oklahoma City and Chickasha fields.

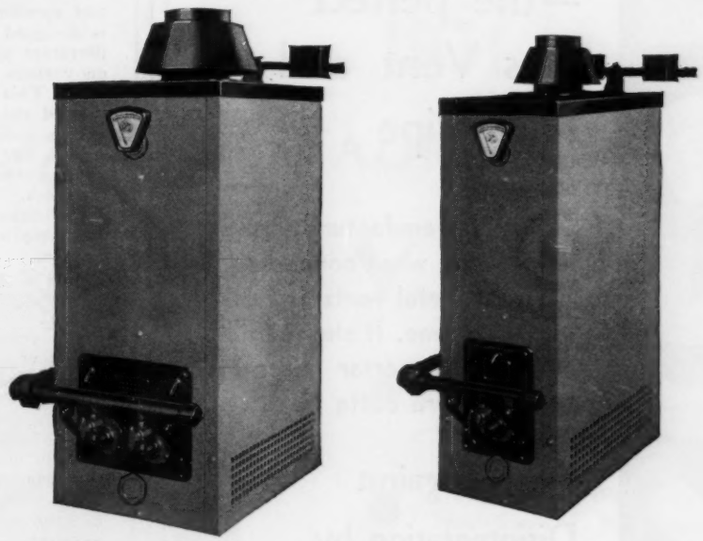
Arrowsmith to Represent Grady Dudley Co.

The T. G. Arrowsmith Co., Pacific Coast manufacturer's representative, headquartered in San Francisco, has taken on for distribution in the territory the complete line of circulating heaters manufactured by Grady Dudley Co., Nashville, Tenn.

Two New Coast Counties Offices

Coast Counties Gas and Electric Co., Santa Cruz, Calif., plans to open new offices at Antioch and Concord, Calif.

IDEAL ARCOLA GAS BOILERS



Furnish hot water radiator warmth for small buildings, with or without basement

The new Ideal Arcola Gas Boiler is a simple, perfected system furnishing automatic radiator heat in buildings where there is no central heating plant.

These boilers are excellently suited for small homes, tea rooms, restaurants, stores, garages and offices. So clean, compact and attractive in appearance are they, that they can be installed in any room and connected with radiators as needed—even on the same floor.

Since they are designed only for hot water, they are smaller and more compact than boilers used for steam. They combine the Arcola "water cooled base" construction with the features that have won leadership for the larger Ideal Gas Boilers.

Include these new Ideal Arcolas in your plans for getting new business! They open up a profit-making field!

manufactured by

AMERICAN RADIATOR COMPANY

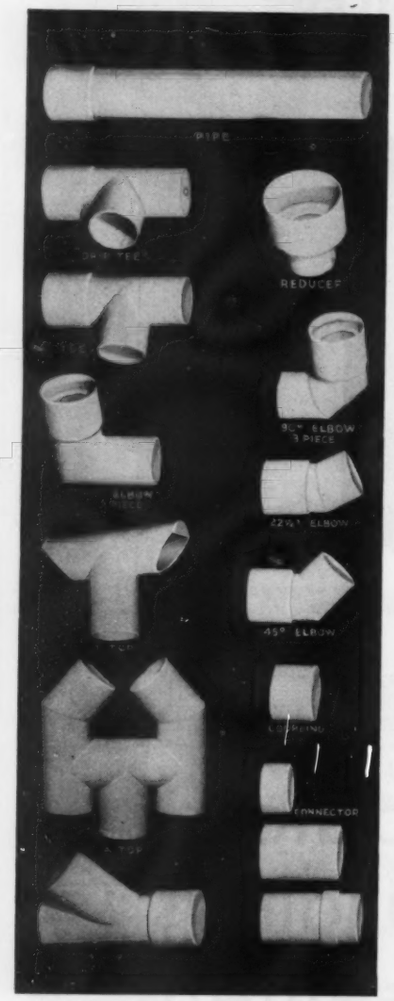
division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

distributed by

American Gas Products Corporation

Chrysler Building, New York

VITEX



—the perfect Gas Vent and Flue Pipe

Burnt manufactured and natural gas, when condensed, eats out metal vents or flues in a short time. It also readily attacks the mortar joints in brick or terra cotta flues.

Guard Against Disintegration by Installing VITEX

Vitex is unaffected by the products of gas combustion.

It increases draught and improves combustion.

Now also made in oval shape—size 2¼ x 6¾" I.D.

PLANT RUBBER and ASBESTOS WORKS

537 BRANNAN STREET . . . . SAN FRANCISCO

070

Reynolds Gas Control Since 1892

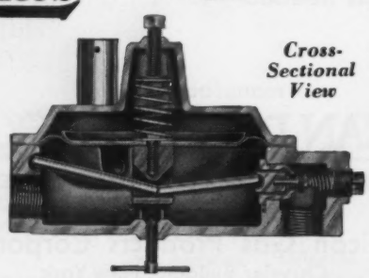
Reynolds Little Giant Regulator

Products for all kinds of Pressure Reduction—for either artificial or natural gas.

GOVERNORS—Intermediate Pressure, Triple Outlet, Holder, Toggle Type Street.

REGULATORS—High Pressure Service, Low Pressure Service, High Pressure Line, Single and Double District Station.

VALVE—Automatic Quick Closing Anti Vacuum.



Cross-Sectional View

Reynolds Gas Regulator Company
Anderson, Indiana

Data on Measurement in American Meter Publications

THE publication department of American Meter Co. factories, announce the release on April 20 of a new 220-page general catalog and reference book, (G-1, 1931) covering products and operating data for the measurement and testing of manufactured, natural or liquified petroleum gases.

This book presents illustrated descriptions and specifications on specific equipment, and is designed to serve as a reference guide to literature published by American Meter Co., on various phases of measurement engineering. This is accomplished by a 2-page colored chart showing a set-up of the company's published information in its relation to the five main sections and the 16 subsections comprising the product data given in the book. Cross reference is used to show the additional operating information that is available to cover a specific product classification.

Several new products and recently introduced improvements are included in the new edition.

The company has also released an attractive new 36-page revised bulletin on meter provers and cubic foot standards for gas meters manufactured by the D. McDonald and Co. factory in Albany, N. Y.

The bulletin includes complete data on the new 5- and 10-foot provers. The capacity of these models has been respectively increased from 950 to 2,300 and from 1,800 to 5,000 cubic feet per hour at 1½-inch inlet pressure. The booklet further includes instruction for operating provers, cubic foot bottles (both immersion and portable type) apparatus for determining meter capacities, and hydro pneumatic meter testers. A check rate and open rate table, meter proving percentage tables and data on the adjustment of meters to accurate proof, are presented.

Appalachian Gas Corp. to Acquire Control of Carbons Consolidated

Appalachian Gas Corp., New York, announces an additional issue of $1,000,000 of its convertible 6 per cent debentures, the capital to be used for the purchase of the common stock of Monroe Consolidated Gas Co., which, through its ownership of a majority stock interest in Carbons Consolidated, Inc., will own and operate natural gas properties located in the Monroe gas field of Louisiana. These properties are now selling natural gas to United Carbon Co., under a long term contract for resale to Interstate Natural Gas Co., supplying gas for Baton Rouge and New Orleans. Properties include 26 producing gas wells having a combined daily open flow capacity of approximately 332,302,000 cubic feet and reserves estimated at about 128,687,425,000 cubic feet of natural gas.

L. L. Langworthy Is Named Assistant to J. P. Davidson

Jack P. Davidson, representative for the Estate Stove Co. in southern California, announces the appointment of Lloyd L. Langworthy as his assistant in that territory. Mr. Langworthy comes from the head office of the Estate Stove Co., Hamilton, Ohio.

Asks Franchise at Baxter Springs

An application is before the city authorities of Baxter Springs, Kan., asking for a natural gas franchise. Mr. Sloan of Miami, Kan., is named as the petitioner.

VULCAN *announces . . .*

Important 1931 Improvements

IN HOTEL AND RESTAURANT GAS RANGES

● This is what the new No. 4751 All-Hot-Top Vulcan looks like. It is but one of the new 1931 line of Vulcan Heavy Duty Ranges designed to meet modern and exacting requirements. This new line opens up great sales opportunities for replacing old equipment. . . . *Address:* Standard Gas Equipment Corp., 18 East 41st Street, New York City . . . *Pacific Coast Distributor:* Northwest Gas & Electric Equipment Co., Portland: San Francisco; Los Angeles.

✓ Check these 1931 High Spots of the new VULCAN RANGES

- **APPEARANCE:** Manifold, hinges and door springs . . . concealed! Clean, smooth front. Easy to *keep* clean.
- **INSULATED OVEN** *(optional):* Thick, rock-wool insulation . . . conserves heat and improves working conditions.
- **OVEN HEAT CONTROL** *(optional):* Maintains any oven temperature desired . . . assures uniform, good results.
- **IMPROVED OVEN:** As efficient for baking as for roasting. Rust-resisting metal linings!
- **IMPROVED TOP:** Heavier construction, reinforced design . . . higher top-temperature.
- **CONCEALED FLUE:** Smarter appearance . . . more working space.
- **DEEPER HIGH-SHELF:** Increased capacity . . . greater convenience for operator.
- **HEAVIER CONSTRUCTION:** Lower maintenance costs . . . longer life.
- **EASIER TO SERVICE:** Parts easily adjusted . . . readily removed for cleaning. All air shutters and gas orifices protected from dust and grease.

VULCAN GAS HOT TOP RANGES

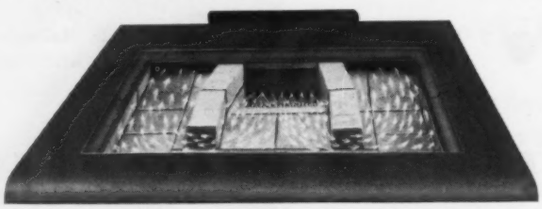
One of Many Madsen Models, each Planned to Secure Maximum Efficiency from Gas.

Products of 20 Years' Experience in Building Hotel and Restaurant Kitchen Equipment for Natural Gas and all Forms of Manufactured Gas

MADSEN RANGES

Designed to render better service with any type of gas . . exactly adjusted to the characteristics of the fuel to be employed . . . making users and friends for gas in all its forms.

Madsen Ranges are standard equipment in the West's largest and most successful popular restaurant systems . . . in the most aristocratic clubs . . . in exclusive hotels and cafes. Wherever found, Madsen Ranges are justifying the confidence the Gas Industry has placed in them.



THE MADSEN SIPHON BURNER

The Madsen Siphon Burner is regarded by competent authorities as the most efficient device yet designed for the consumption of natural gas and manufactured gas fuels. The Madsen System of Heat Circulation, pictured above, utilizes the full efficiency of the fuel.

MADSEN IRON WORKS, Ltd.

P. O. BOX 601, HUNTINGTON PARK, CALIF.,
(Suburb of Los Angeles)

SAN FRANCISCO Factory Representative:
Fred R. Sanford, 631 Second Street

GAS BURNERS

For

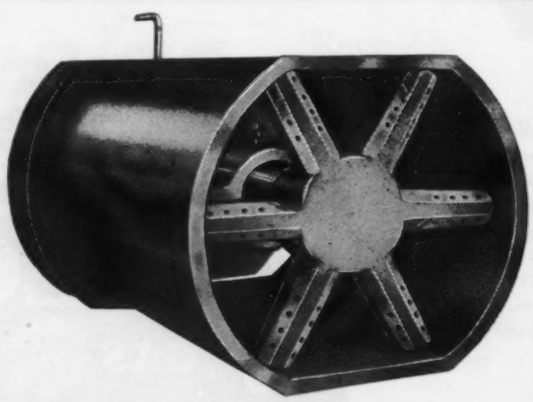
ALL INDUSTRIAL PURPOSES

JOHN ZINK CO.

Oklahoma Natural Gas Bldg.
Phone 4-9838
TULSA, OKLAHOMA

★

Flameless Burners
Flame Burners
Short Flame Burners



Gas Products Assn. Publishes New Book on Welding

The Gas Products Association, Chicago, an association of independent manufacturers of gas welding and cutting equipment and supplies, has just issued a 44-page booklet on pipe welding.

This booklet contains information on phases of the various types of welded steel and wrought iron piping systems for industrial uses. The subjects covered include, alignment, spacing, tacking tables for the lay-out of templates for cutting pipe intersections, branches, reducers and bull-plugs; the fabrication of headers, the use of tube-turns, long neck welding flanges and the construction of expansion loops and anchors. In addition to this, the booklet contains tables of cost data for the welding and cutting of all sizes of pipe from ⅜-inch to 30-inches in diameter.

The book is available to the industry through any of the association members, or by direct application to the association office, 250 E. Ontario St., Chicago, Ill. The price is 50 cents.

Canadian Resources, Ltd., to Open Negotiations at Saskatoon

Representatives of the British firm backing the Canadian Resources, Ltd., seeking a natural gas franchise for the city of Saskatoon, Sask., expected to arrive in that city during mid-April to open franchise negotiations with the city council.

Establishment of a system which would supply Saskatoon, as well as Regina and Moose Jaw, is proposed. Wells located in the Fabyan area would be the source of supply.

A. S. Sibbald, Saskatoon barrister, representing the gas company, states that all arrangements for financing the proposed development have been completed.

Hilo Gas Co., Hilo, T. H., Constructing New Gas Plant

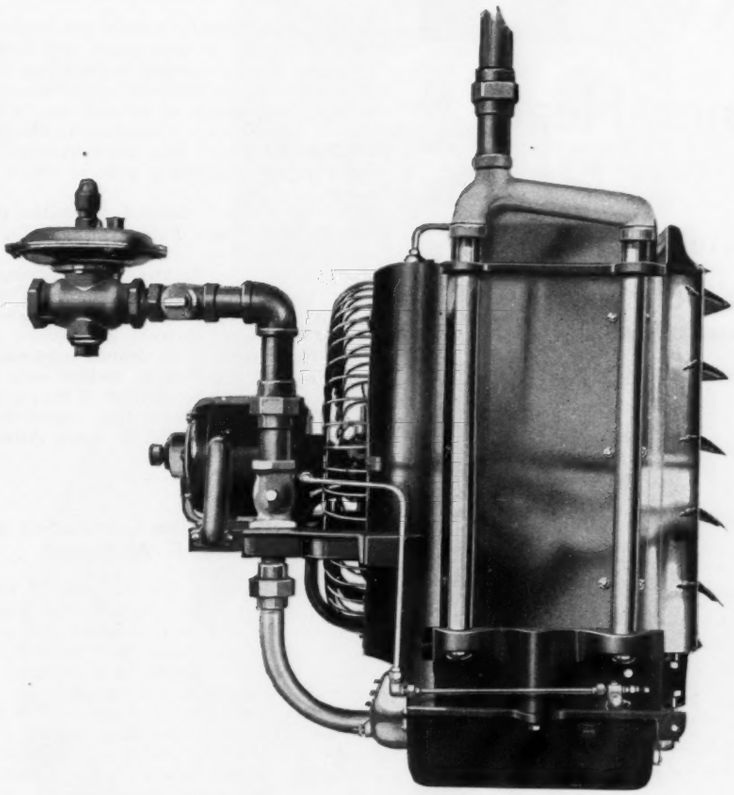
Hilo Gas Co., Hilo, Hawaii, is beginning construction of a new oil gas plant to be in service by the first of August. High pressure storage facilities for 80,000 cubic feet of gas will be provided in two tanks, 9-feet, 9 inches by 46 feet. Other equipment will include a motor driven compressor. Pipe is also being ordered for converting a portion of the existing system from low to high pressure. Construction of the plant will be under the supervision of the Jones Gas Process Corp., San Francisco, Calif.

Community Natural Organizes Special Range Sales Crew

A special range crew, devoting its time to selling console type ranges, has recently been organized by the new business department of the Community Natural Gas Co., headquartered at Dallas, Texas, and operating in northern Texas and southern Oklahoma. The crew, L. J. Tanner, Fain Henderson, and E. L. Turner, will work in each of the company's 16 districts. E. H. Durning is crew leader.

Line Begun to Serve Fort Stockton, Texas

Big Bend Gas Co., has begun operations on a natural gas transmission line from the Pecos County gas field to Fort Stockton. Sidney S. Woods is manager of the company.



For the Natural Gas Heating Load:

HUMPHREY
GAS UNIT HEATER

THE natural gas domain is widening. Soon its frontiers may be pushed out to include the whole continent. With every new extention there must be an increase in the gas load. Domestic consumers are not enough. It is to the industrial and commercial users that the gas companies must now turn.

THE Humphrey Gas Unit Heater opens up as never before the sales possibilities of gas heating to factories, stores, garages, offices, theaters and churches. Unit heating is an established fact. Its popularity with builder, owners and engineers is already well known.

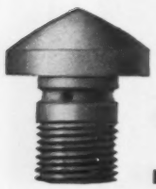
Through the Humphrey Gas Unit Heater this enthusiasm is translated into sales for the gas industry. Investigate this important Humphrey product. It helps you to secure the load that makes natural gas lines possible.

General Gas Light Company
Kalamazoo, Michigan

C. B. Babcock, Pacific Coast Manager, 135 Bluxome St., San Francisco

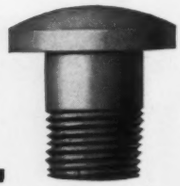
ALCO LAVA

Pilot Tips and Burner Heads



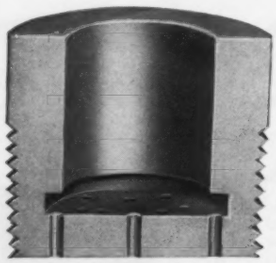
Innumerable Styles Are Being
Made by Us for
Gas Appliance Manufacturers

WHY NOT FOR YOU?



INDUSTRIAL GAS BURNERS

For Artificial
or Natural Gas
Covered by
U. S. Patent
No. 1498644
and 1769821



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Non-Corrosive
Unchangeable
Practically Everlasting
Cheaper—Better

Send for New Gas Book No. 31

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1431 Williams St. Chattanooga, Tenn.

DEPENDABLE PROTECTION for Pipe Lines

McEVERLAST Coatings
+Mechanical application
+Engineering service
=Complete,
Dependable
Protection

McEVERLAST, Inc.
111 West 7th St. Russ Building
LOS ANGELES SAN FRANCISCO

Flexible Leak-Proof

Victaulic

Pipe Couplings

Distributed by

DUCOMMUN CORPORATION

Los Angeles - San Francisco

W. D. von Kennell to Direct Arizona Change-Over Operations

W. D. von Kennell, natural gas engineer employed by the Peoples Light and Power Corp., is at present engaged in compiling data and supervising preliminary operations incidental to the coming of natural gas to the Arizona Edison Co.'s properties at Douglas and Bisbee, Ariz. His headquarters are located in the company's general offices in Phoenix.

Mr. von Kennell directed a similar program for the Texas Public Service Co. at Austin, Texas.

Gas is now manufactured and distributed by the Arizona Edison Co. in Bisbee, Douglas, Globe, Miami and Yuma. Of this group, the first to receive natural gas service are Bisbee and Douglas. No definite information is available at this time as to how soon the other localities may be included in the natural gas network. This new fuel, piped from Texas fields, is expected to reach Arizona early this summer.

Ray V. Harshman Now Combustion and Sales Engineer for F. A. Nemec

Ray V. Harshman, for the past 20 years combustion and sales engineer for Rotary Manufacturing Co., has resigned that position to accept a similar post with F. A. Nemec, Whittier, Calif., manufacturer of combustion engineering equipment.

Mr. Nemec has developed a number of new types of gas burners including radiant types for domestic furnaces and cast iron sectional and other heating boilers. These burners were first introduced in September, 1930. Peninsula Burner and Oil Co. at 885 Harrison St., San Francisco, is handling sales in the northern California district and maintains offices in San Mateo, Palo Alto, San Jose and Oakland.

Largest Candy Factory in Middlewest Using Natural Gas

The Council Bluffs Gas Co., Council Bluffs, Iowa, has just recently completed an industrial installation at the John G. Woodward Candy Co. The Woodward Co. is the largest candy manufacturing firm in the middlewest and has for many years employed gas in the candy cooking, kettles, and roasting ovens.

The Woodward Candy Co. operates three 150-h.p. boilers, generating its own electricity and operating a large refrigeration plant. The boilers operate 24 hours a day every day in the year.

Portland Gas & Coke Co. Closes Dallas Office

Portland Gas & Coke Co., Portland, Ore., has closed its Dallas, Ore., office, and will manage the district from its Salem office. Merchandising for Dallas will be continued by the Sterling Furniture Co. Howard Dippert, formerly office manager at Dallas, has been transferred to a similar post at Gresham.

Southern Counties Completing Two High Pressure Holders

Southern Counties Gas Co., Los Angeles, Calif., is completing construction of two high pressure gas holders at San Pedro, to be placed in service within the next 60 days.

Better heat at lower cost . . . that's what a CECO Gas Burner assures. The purchaser of a CECO has as his guarantee of satisfactory performance the long and comprehensive service of skilled combustion experts . . . and gas companies who recommend CECO to their patrons are sure of customer satisfaction.

There is a CECO Burner for every need . . . for boilers, large or small, oil stills, bake ovens, melting pots, cracking stills, flue gas re-circulation systems, heating plants and fully automatic residence units. Whether it's for heating or industrial use, you'll find there's a CECO Burner especially designed to give the most economical, the most dependable operation. Write for bulletins.

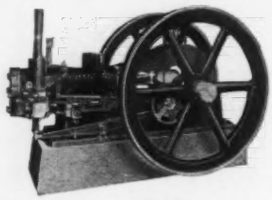
COMBUSTION EQUIPMENT COMPANY

GENERAL OFFICE: KANSAS CITY, MO.

WICHITA MEMPHIS HOUSTON

Increase Your Industrial Load With Natural Gas Engine Power.

USED FOR:
Ice Plants
Cotton Gins
Pumping Plants
Laundries
Brick Plants
Electric Generating
Manufacturing Plants



Gas engines save over Electric Motors Steam Engines Gasoline Engines and Oil Engines. Their savings are so great you will be surprised.

WRITE US FOR FULL INFORMATION ABOUT THESE SAVINGS

CHARTER GAS ENGINE COMPANY - STERLING, ILLINOIS

Manufacturers of Dependable Gas Engines Since 1880

Single Cylinder 25 to 100 h.p. **Double Cylinder 60 to 200 h.p.**

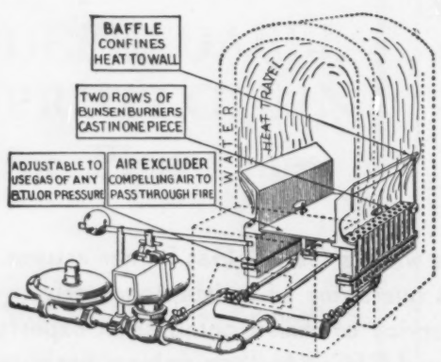
Newman Gas Equipment Co.

Industrial and Commercial Burners

Upshot Burners for Ideal Boilers

Bailey Regulators for Gas Fuel and Pressure Regulation

447 Sutter Street **San Francisco** **Ph. GA 7833**


BAFFLE CONFINES HEAT TO WALL
TWO ROWS OF BUNSEN BURNERS CAST IN ONE PIECE
ADJUSTABLE TO USE GAS OF ANY B.T.U. OR PRESSURE
AIR EXCLUDER COMPELLING AIR TO PASS THROUGH FIRE
WATER
HEAT TRAPPED

Perfect combustion correctly applied insures maximum efficiency

Noiseless, Sootless

Ideal for any size cast iron and fire-box boilers.

FAUCHER GAS BURNER, INC.

Box 5031 **Dallas, Texas**

STANDARD MANAGEMENT & OPERATING CORPORATION

225 Bush Street San Francisco, Calif.

PUBLIC UTILITY MANAGEMENT
ENGINEERING AND CONSTRUCTION
REPORTS AND APPRAISALS

The staff includes the following who have been associated with successful nation-wide public utility enterprises for several years past.

E. F. ENGLISH
E. A. OLSEN
R. N. DREIMAN
JOHN COLLINS, JR.
J. B. WILSON
A. E. HALL
CHAS. GRUNSKY

Memphis Natural Gas Co. Sales Continue to Increase

Memphis Natural Gas Co., Memphis, Tenn., affiliated with Appalachian Gas Corporation, reports sales of natural gas for March of 953,114,200 cubic feet, against 798,451,500 cubic feet for March last year, a gain of over 19 per cent. Sales for the 12-month period ended March 31, 1931, totaled 9,546,226,900 cubic feet, against 7,877,078,080 for the preceding 12-month period, a gain of over 21 per cent. Gross revenues from the sale of gas only during March, 1931, were $172,413, against $145,397 for March last year, a gain of over 18.6 per cent.

D. C. Shaffer, vice president, in commenting on the report, pointed out that the large gain in consumption during March is in line with the upward trend of the past few months, February gain having been 16 per cent while that for January was 12 per cent; the gains, recorded despite an unusually mild winter, being due to greater demands resulting from increased industrial activity and substantial additions of new customers.

Gas Co., Furniture Dealers, and Newspaper Cooperate for Gas Sales

A dinner was held on April 7 at the New Washington Hotel in Seattle, Wash., at which the entire sales organizations of Seattle Gas Co., Grunbaum Brothers Furniture Co., Standard Furniture Co., Grote-Rankin Furniture Co. and the advertising managerial staff of the Seattle Times met to hear a talk on "The Future of the Gas Business and Modern Trends on Selling," by J. J. Genthner, sales educational director of the Central Public Service System.

The Seattle Times, in cooperation with the Seattle Gas Co. sponsored a cooking school which started on April 21, and the support of the furniture dealers was pledged at the dinner meeting.

United to Open Office at Sinton; Moves Huntsville Headquarters

United Gas Public Service Co. has moved its Huntsville, Texas, office from the Lamkin Bldg. to the Eastham Bldg. at Ave. L and 12th St.

The company also plans to open a district office at Sinton, Texas, with Ray N. Franklin, formerly manager of the Seagraves Gas Co., of that town, in charge. United is now operating the Seagraves Company.

Ground Broken for Herndon Electric Power Plant

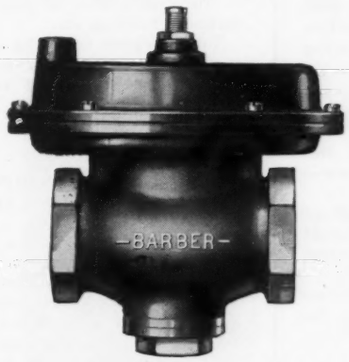
Ground has been broken by San Joaquin Light & Power Corp. for its new steam plant sub-station at Herndon, Calif., 11 miles north of Fresno. Natural gas will be used as the fuel to generate the power, a line having been completed to Merced, Calif., recently. The Herndon station is located near the route of this line.

Franchise Elections Scheduled for Late April in Montana Towns

E. B. Coolidge of Great Falls, Mont., has applied for franchises for permission to serve natural gas in Big Sandy and Fort Benton, and elections were scheduled to be held there during the last week in April.

BARBER SUPERIOR GAS PRESSURE REGULATORS

A Guarantee to Your Customers Against High Gas Bills—and Good Profits for You—



Read This Convincing Testimonial.

H. C. REYNOLDS
Sanitary Plumbing—Hot Water and Hot Air Heating Metal Work
46 Wing Street
Phone Clifford 4556
New Bedford, Mass.

March 9, 1931

The Barber Gas Burner Co.,
3702 Superior Ave.,
Cleveland, Ohio.

Gentlemen:

I purchased one of your Gas Pressure Regulators from my local Supply House about two months ago. I installed it in my house to try it out.

My January bill was $.96 and my February bill $1.00. My gas bills for the last four years have been running about $3.50 per month on the average.

To say I was surprised is putting it mildly. I now intend to go out and push this regulator as I now know it will do every bit you say it will, and more in my case. I enclose a circular, one of which you sent me some time ago. Can I have some more of these circulars at your earliest convenience?

Sincerely,
Signed: H. C. Reynolds.

THE BARBER GAS PRESSURE REGULATOR IS A RELIABLE PRECISION DEVICE : :

Neat, rugged and durable, its remarkable accuracy is built in for permanence. High grade bronze valve with all brass working parts. Springs of special phosphor bronze. Diaphragms of highest grade sheepskin, specially treated to withstand normal house service gas pressures.

Barber Pressure Regulators maintain *uniform* and *constant* supply of gas to the burners, preventing incomplete combustion and *waste* of gas. Eliminates risk of failing pilot lights and puffing out of burners.

WHY NOT ORDER A SAMPLE BARBER REGULATOR NOW TO PROVE THE MERITS OF THIS PROFITABLE BUSINESS BUILDER?

Consumer literature, sales helps and DISCOUNTS WILL BE SENT TO YOU, UPON REQUEST. *WRITE TODAY!*

Create GOOD WILL by installing Barber Pressure Regulators on house service gas lines.

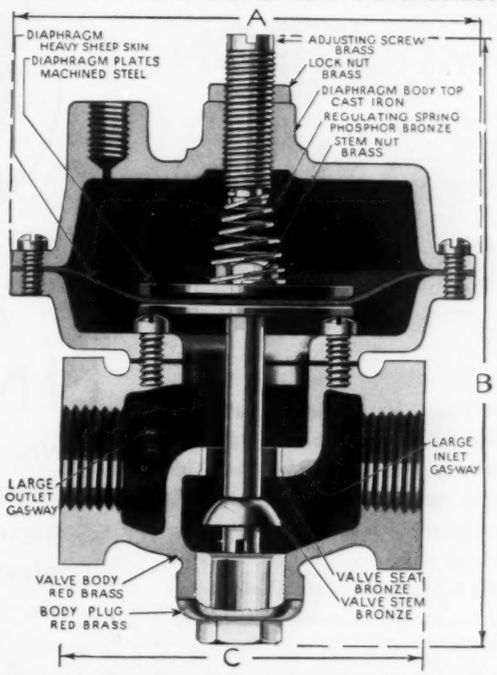
These facts will cause your customers to make the small investment that will give them this new Barber Gas Regulator Economy.

SAFETY—They provide safety from high and irregular gas pressures that produce fumes and poisonous unburned gases.

ECONOMY—They prevent waste of gas, quickly paying for themselves through lower gas bills.

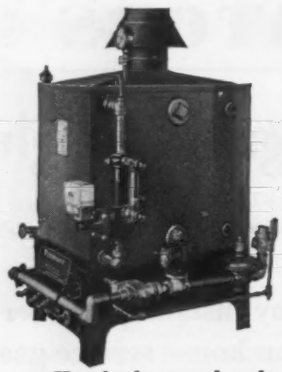
SERVICE—They assure more satisfactory service from all Gas Appliances served by the meter.

NOTE THESE SUPERIOR FEATURES:



Sizes: ¼, ⅜, ½, ¾, 1 and 1¼ inch made with brass bodies.
Sizes: 1½ and 2 inch made with iron bodies and brass seats.

THE BARBER GAS BURNER CO. 3702-3704 Superior Ave. CLEVELAND, OHIO



The Pittsburg A Famous Boiler

The crowning engineering achievement in the gas boiler industry has been the design and perfection of the famous "Pittsburg" Boiler, the most advanced gas-fired house-heating boiler of the day.

Hundreds upon hundreds of installations have definitely proven the superiority of the "Pittsburg," achieving a fame that is rapidly spreading to all parts of the country.

Back of the design and construction of the "Pittsburg" Boiler rests the manufacturing resources of the worlds' largest water heater manufacturers—The Pittsburg Water Heater Company.

The "Pittsburg" label on these boilers is your assurance of the highest mechanical and engineering perfection, a service organization that extends into every town and city of any importance in the land, and an iron-bound guarantee of proven dependability.

Just as "Pittsburg" Water Heaters have demonstrated their superiority, so you will find "Pittsburg" Boilers rendering unsurpassed service wherever installed.

Write for booklet, prices and discounts.

"Efficient House Heating With Gas."
"Pittsburg House Heating Boilers."

Pittsburg Water Heater Company
Factory and General Office: Pittsburgh, Pa.
Offices in all principal cities.

DUAL COMBUSTION

COMBUSTION EQUIPMENT · LEAHY · LOS ANGELES CAL. U.S.A.

DUAL COMBUSTION MEANS FUEL ECONOMY

WITH equally high efficiency, Leahy Dual Combustion Furnaces burn any grade of fuel oil and high or low pressure gas. Both fuels may be used together or separately. One is changed to the other without loss of time or sacrifice of efficiency. This Fuel Flexibility permits the maintenance of strict boiler economy and is a protection against fuel failure.

◆

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Established 1902
1804-1812 East Eighth Street, Los Angeles, California
E. A. CORNELY INC.
1452 Bush Street, San Francisco, California

NEW YORK'S NEW

HOTEL LINCOLN

Where modern scientific planning and management make possible rates surprisingly moderate. 1400 Rooms, each with bath and shower.

$3-5 For One $4-7 For Two

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Times Square · NEW YORK

Carnegie Institute Announces 3rd International Conference on Coal

The Carnegie Institute of Technology announces a Third International Conference on Bituminous Coal to be held at Pittsburgh, Pa., November 16-21, 1931. The purpose of the congress is to present for discussion the results of recent studies of coal, emphasizing improved methods of utilization and their economic value. The program will include papers on the carbonization, liquefaction, and gasification of coal and its by-products; the mechanism of combustion; cleaning of coal and its preparation for the market; its use as pulverized fuel, in power plants, and for domestic heating, etc.

Technologists from the principal European countries as well as from the United States are expected to attend the sessions of the conference.

Appalachian Gas Corp. Acquires Union Management & Engineering Corp.

Appalachian Gas Corp. announces that it has acquired from Union Utilities, Inc., the entire outstanding common stock of Union Management and Engineering Corp., operating managers of subsidiaries and affiliated companies in Appalachian Gas Corp. group. This move consolidates the operating structure of Appalachian through unification of control, and will result in a saving in management costs.

Union Management and Engineering Corp. was organized in 1928 to manage both natural and manufactured gas properties. Under its supervision the 210-mile pipe line of Memphis Natural Gas Co. was constructed.

Barber Gas Burner Co. Offers Two New Descriptive Bulletins

The Barber Gas Burner Co. of Cleveland, Ohio, has recently brought from the press a supplement to its catalog No. 30, containing six pages, and describing the new phases of the "M" series Barber burners with manual control and the "B" series with motor gas valve control. A four-page broadside descriptive of the Barber gas pressure regulator, illustrated with 2-color cuts and line diagrams, is also a recent publication. Copies of each may be obtained by addressing the company at 3702 Superior Ave., Cleveland.

City of Coalinga Signs Contract With Coast Natural Gas Co.

Coalinga, Calif., has contracted with Coast Natural Gas Co. for natural gas to be delivered for five years at the rate of 15 cents per 1,000 cubic feet for the first 3,000,000 cubic feet each month. Twelve cents will be charged for each additional 1,000 cubic feet. Supply comes from the Kettleman Hills field.

Central States Electric Co. Plans Installation of Air Blast Machine

Central States Electric Co., plans installation of a new automatic air blast machine at its gas plant at Fairmont, Minn.

Vote for Municipal System

Citizens of DeLeon, Texas, have voted to install a municipal gas distribution system to cost about $15,000.

This Special Refrigerator Department

STEPPED UP ELECTROLUX SALES

555%

MISS MARY DILLON, ***President of the Brooklyn Borough Gas Company, with 60,000 customers, tells how special refrigerator department made money.***

"IT was started only a few months ago, but already it's a paying department," says Miss Mary Dillon, President of Brooklyn Borough Gas Company.

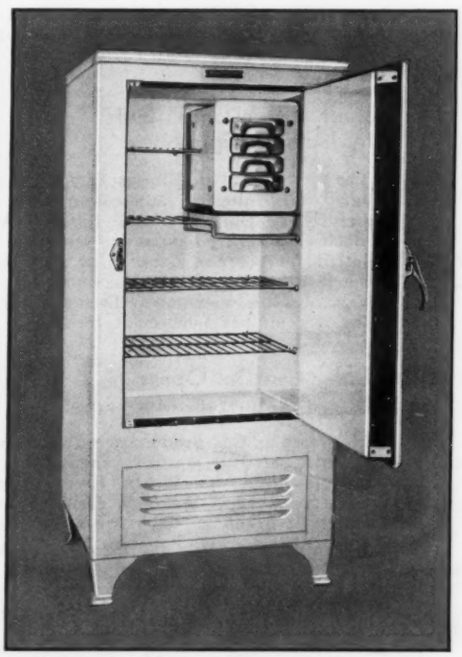
"For example, January and February are not months when you'd expect many refrigerators to be sold. But if you can sell in those months, it's a pretty good indication of what you can do during the rest of the year. This year we sold more than five times as many refrigerators as in January and February 1930 when we included Electrolux sales with other appliance sales.

"Such response to our effort showed that our old method barely scratched the surface of possible refrigeration sales. Now we're going after the business!"

Your company, too, may be just "scratching the surface." Think for a moment. How many customers do you serve? Suppose you installed Electrolux in only one-quarter of those homes. Multiply that figure by 1500 cu. ft. per month, and you have some idea of the load-building possibilities of Electrolux.

But how can you sell that many Electrolux refrigerators?

We'd like to say "Easy"! But like anything worth going after, it does require time and effort. The experience of the Brooklyn Borough Gas Company indicates one good way—a special department. There is also a carefully worked out plan . . . which includes catalogues, newspaper announcements, and a method of securing apartment house business (Plan A) . . . that is available for the asking. But the important thing is the first step—writing, wiring or telephoning for co-operation from Electrolux Refrigerator Sales, Inc., Evansville, Ind.



THE KITCHENETTE—*popular Electrolux model for kitchenette, and apartment kitchen. Has 6.5 square feet shelf space area.*

ELECTROLUX

THE *Gas* REFRIGERATOR

FRASER

Gas Furnaces and Heating Appliances

A complete line of warm air equipment designed and constructed for gas fuel

Console Circulating Heaters
Floor and Wall Furnaces
Basement Furnaces

"It's the INSIDE of the furnace that counts"

Fraser is another word for Quality

Write for descriptive catalog and prices
Manufactured by

FRASER FURNACE CO., Inc.

Stockton, Calif.

California Distributors: H. R. BASFORD CO. San Francisco Los Angeles

IMUNOL

Reg. U. S. Pat. Office
U. S. and Foreign Patents Granted

WILLIAMS
GAS STEAM RADIATOR

Made in 22 sizes from 26 to 180 feet of rating.

IMMEDIATE HEAT AUTOMATIC LIGHTER

Improved Combustion. Positive Gas Control.

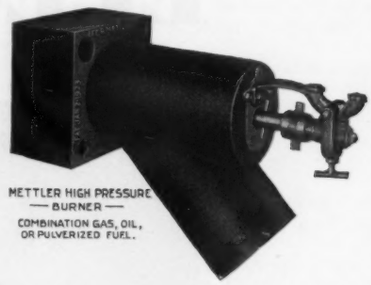
Write for descriptive matter and prices.

WILLIAMS RADIATOR COMPANY

1865-1873 Cordova St. Los Angeles, Calif.

Mettler Announces New High Pressure Burner

A new high-pressure, water-cooled burner has been developed by the Lee B. Mettler Co., Los Angeles, Calif., for burning gas, oil or pulverized coal, separately or in combination. The burner is made of heat- and corrosion-resistant material and is arranged for water-cooling. Gas is supplied to the burner through a single inlet pipe, and is delivered from a number of orifices placed



Burner assembly for combination fuel

around the circumference of an annular gas chamber. Combustion air is forced through the center of the burner at high velocity. If fuels other than gas are to be used, they are likewise injected through the center of the burner.

The appliance is available in three sizes, 8-, 6-, and 3-in. pressure air or pulverized fuel connections. The gas inlets are 2-, 1½- and 1-inch, while the water connections are 1-, ¾-, and ½-inch, respectively.

Oklahoma Natural to Instruct Consumers in Meter Reading

Oklahoma Natural Gas Corp., Oklahoma City, has prepared meter reading cards for distribution to all consumers. These cards enable consumers to keep a check on their meter readings, and also give instructions on how to read a meter. Supplies are being sent by the company to each city it serves.

Robert H. McDonnell Gets City Industrial Franchise

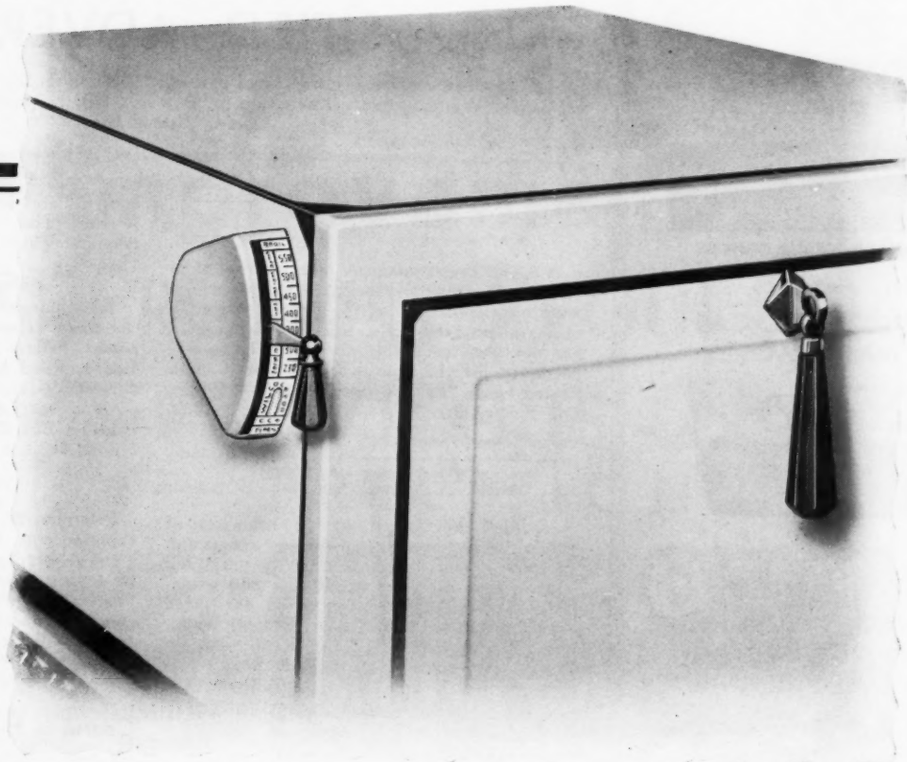
The city council of Kansas City, Mo., has granted the franchise application filed by Robert H. McDonnell of the Burns & McDonnell engineering company to serve gas for industrial purposes in Kansas City. Mr. McDonnell plans to organize a company and sell gas in the downtown district at from 20 to 30 cents per 1,000 cubic feet.

Messler Gas Co. Opens Office at Cameron, Mo.

Messler Gas Co., headquartered at Kansas City, Mo., recently opened headquarters at Cameron, Mo., with W. H. Reed, auditor, in charge. The company is carrying on a drilling program in the vicinity of Kerr, Turney, Lathrop and Fordham.

Weston Scheduled for Service

Cities Service Gas Co., is constructing a line to serve Weston, Mo., supply coming from the Platte City line of the company, recently completed.



NOTE how close to the oven side the Console Wilcolator sets. Only 1" thick. Convenience and beauty mark this latest Wilcolator.

Comment by a Large Range Buyer on the NEW Console Wilcolator

A man who buys (and sells) over 20,000 gas ranges every year writes us:

> "I think it will be practically impossible to market anything but a console model gas range, and in view of this there will be a greatly increased demand for your type of control (the Console Model Wilcolator), because to date it seems to be the only thing adapted and designed especially for the newer type range."

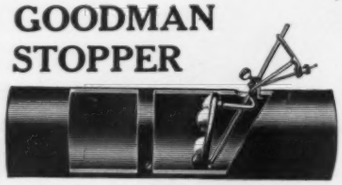
Further comment by us would be superfluous, except to remark that the Console Model Wilcolator has a new beauty and attractiveness, plus an immediate cold check, full vision temperature strip, and an enameled casing to match the trim of your range.

You must see it to appreciate its great sales value. Samples and prices sent on request.

THE WILCOLATOR COMPANY, Newark, N. J.

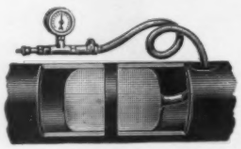
Specialists in Temperature Control for Household Appliances

THE
GOODMAN
STOPPER



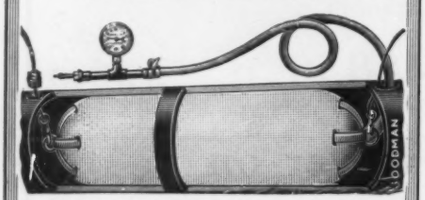
WHEN LOCKED IN PLACE IT HOLDS

DEPENDABLE GAS
MAIN BAGS



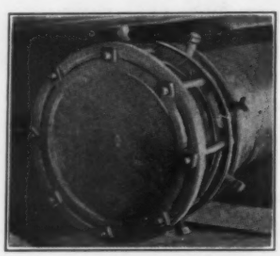
Type C

GOODMAN CYLINDRICAL
STOPPER FOR INTER-
MEDIATE PRESSURE



Increased Length for Increased Pressure

KRUPA-HENDRY
TEST CAP



For Testing High Pressure Lines

SHIPMENTS FROM STOCK

SAFETY GAS MAIN
STOPPER COMPANY

523 Atlantic Avenue
BROOKLYN, N. Y.

Pac. Coast Rep.: C. B. Babcock Co.
135 Bluxome Street, San Francisco
California

CLASSIFIED ADVERTISING

Classified advertising five cents per word; minimum $2.00 per insertion. Situation Wanted advertisements up to 50 words will be published three consecutive issues without charge.

HELP WANTED

WANTED—A man to take charge of a small gas property operated in connection with an electric property. Total population of city about 8,000. Gas meters 413. Property has not been profitable and there is an opportunity for the man who can put it on a paying basis. Eastern Oregon Light & Power Co., Baker, Ore.

SITUATIONS WANTED

Auditor experienced in all branches of public utility accounting desires connection on West Coast. Applicant is 38 years old and has had 16 years accounting and statistical experience. Also qualified for office management or treasury department work Now employed in Mid-Continent field in natural gas accounting. Address Box E-125, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Electrical and mechanical engineer with over 12 years experience in design, development and construction of heating appliances and automatic controls pertaining to same, familiar with shop practice and supervision of manufacturing as applied to the gas industry, seeks position. Address Box E-121, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Superintendent of measurement and distribution of natural gas desires new connection. Thirteen years experience in all branches of the gas industry, including production, transportation, measurement and distribution, both domestic and industrial. Technical graduate, employed at present. Married. Address Box E-123, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Distribution Engineer, age 34, with 8 years experience in designing, operating and maintaining distribution systems, desires managerial connection with small gas company or operating unit. Thoroughly conversant with technical and supervisory procedures, and well qualified in accounting and commercial practices. Responsibly employed at present with large western utility. Address Box E-117, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Appliance and service man familiar with change-over work desires position in gas company in California, Washington or Oregon. Has had experience on the Denver change-over, also at Salt Lake City and Springfield, Ill. Address Box E-119, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Experienced gas meter repairman desires position. Has had three years experience in repairing large and small capacity meters, both tin and iron case. Address Box E-127, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif

Sales manager, 9 years experience in merchandising for natural gas distributing companies, desires sales position on Pacific coast. Has handled house-heating, commercial and domestic sales. Applicant would also accept position as manufacturer's representative. Address Box E-131, *Western Gas,* 124 West Fourth St., Los Angeles, Calif.

Salesman desires position. Has had 2 years experience in Kansas City in appliance and house-heating sales, also 10 years experience in selling other lines. Will not sell stock. Prefer new property. Applicant can furnish good references. Apply Box E-128, *Western Gas,* 124 West Fourth St., Los Angeles, Calif.

Course in Home Cookery Announced by Canadian Western

The Canadian Western Natural Gas, Light, Heat & Power Co. Ltd., Calgary, Alberta, announces the opening of a two-months course in home cookery in the company's new Home Service auditorium. Miss Hesperia Lee Aylsworth, home service director, will be assisted in conducting the course by Miss Gertrude Chamberlain, recently graduated from the University of Alberta.

Mayer & Oswald to Represent Meriam in Chicago

The Meriam Co., Clevelad, Ohio, manufacturer of flow meters, draft gauges, filter flow meters, "U" and well-type manometers and pulsation shock absorbers for pressure gauges, announces the appointment of Mayer & Oswald, 332 South LaSalle St., Chicago, Ill., as sales representative in the Chicago territory.

Medicine Hat Votes to Spend $82,500 on Development

The rate-payers of the city of Medicine Hat, Alberta, have passed a by-law to raise $82,500 for the expansion program for their natural gas utility. This money will be used for exploration in sinking and developing new wells in producing regions hitherto untapped.

Leo Friedman, President of Cleveland Water Heater Co., on Coast

Leo Friedman, president of the Cleveland Water Heater Co., was a Pacific Coast visitor during March and April, during which time he called on the utilities and devoted special attention to a study of merchandising problems and methods of distributors of liquefied petroleum gases.

. . . . . the latest *major* improvement *in* GAS PRESSURE REGULATION

WILGUS - N. G. E. PRECISION PILOT

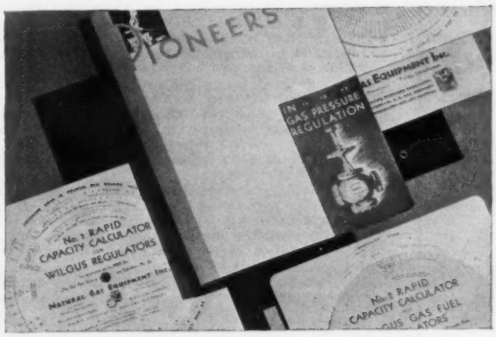
ELIMINATION OF continuous bleed of operating medium . . . positive and more sensitive control of main valve without "hunting". . . operation on any convenient air, gas, or liquid pressure which *need not be constant* . . . practical freedom from service interruption . . . these are some of the outstanding contributions of the Wilgus-N. G. E. *Precision* Pilot to improved pressure regulation.

The *Precision* Pilot is shown applied to the Wilgus-N. G. E. Series 60 Regulator for 600 and 1200 pounds safe working pressures. It is applicable to all Wilgus-N.G.E. Regulators for pilot operation . . . interchanging with the previous pilot regulator.

The N. G. E. *Precision* Pilot Liquid Level Controller . . . now regularly supplied with KA2 Stainless Steel floats and the N. G. E. Micrometer Lever Clamp . . . and the Wilgus-N. G. E. Manual Remote Control Valve are other applications of the *Precision* Pilot.

• • •

Your copy of this 60-page, profusely illustrated catalogue of Wilgus Regulators . . . and the widely used N.G.E. Capacity Calculators.. No. 1 for high pressures, No. 2 for low..sent with our compliments on request.



The Wilgus-N. G. E. Precision Pilot . . . shown here circled on the Series 60 Regulator for 600-1200 pounds working pressures . . . continues the progress of improved regulation pioneered with the Wilgus spring-loaded, ball-bearing mounted regulator of 1902.

NATURAL GAS EQUIPMENT, INC.

LOS ANGELES . . . Petroleum Securities Building
SAN FRANCISCO . . . . . 1123 Harrison Street

WILGUS-N. G. E. PRESSURE REGULATORS N. G. E. GAS BURNERS
ANUBIS DIFFERENTIAL PRESSURE INSTRUMENTS
Pacific Coast Distributors for
WEBSTER ENGINEERING CO., TULSA . . SURFACE COMBUSTION CO., TOLEDO

LOOK TO THE PIONEERS FOR CONTINUED LEADERSHIP

The
BARTLETT HAYWARD CO.
Engineers and Founders
BALTIMORE NEW YORK

DESIGNERS AND BUILDERS
OF
COMPLETE COAL GAS PLANTS

CARBURETTED WATER GAS PLANTS

BY-PRODUCT PLANTS

DE BROUWER CHARGING AND
DISCHARGING MACHINES

SALT WATER AND FRESH WATER
CONDENSERS

PURIFIERS

SHAVING SCRUBBERS

CENTRIFUGAL VERTICAL TYPE
SCRUBBERS

STEEL TANKS

VERTICAL WASTE HEAT BOILERS

GAS HOLDERS

IT'S
"MATCHLESS"
Electrogas
FLOOR
FURNACE
—proven economy and
efficiency through
ten years of service

NATURAL GAS
is creating the demand for installation in
OLD AND NEW HOMES
MADE IN SEVERAL SIZES
TO MEET ALL REQUIREMENTS
Write for
Attractive Dealer Proposition
ELECTROGAS FURNACE CO.
466 Sutter Street
SAN FRANCISCO, CAL.

B. C. Electric to Serve North Vancouver Through Submerged Mains

British Columbia Electric Railway Co., Vancouver, B. C., through its subsidiary organization, the B. C. Electric Power & Gas Co. Ltd., has applied for Federal permission to lay a submerged gas main across Burrard Inlet at the Second Narrows, to supply gas to North Vancouver, B. C.

Supply of gas to the municipalities of North and West Vancouver, and the city of North Vancouver, had been provided for by pipes laid across the Sound Narrows Bridge, and construction of a small storage holder. Prior to the inauguration of service, however, the bridge was carried away in a shipping accident. Reconstruction of the bridge has been indefinitely suspended.

Apply to Serve Five Mo. Towns

Richard and Paul Gaston have applied for permission to serve gas to the towns of Webb City, Oronogo, Neck, Purcell and Alba, Mo. Reports state that the towns will be supplied from an extension from a main line near Harrisonville.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.,

Required by the Act of Congress of August 24, 1912, of *Western Gas*, published monthly at Los Angeles, California, for April, 1931.

State of California,
County of Los Angeles—ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Jay Jenkins, who, having been duly sworn according to law, deposes and says that he is the publisher of *Western Gas*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher—Jay Jenkins, Los Angeles, California.
Managing Editor—Geo. H. Finley, Los Angeles, California.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)
Western Business Papers, Inc., Los Angeles.
Jay E. Jenkins, Los Angeles, Calif.
James E. Jenkins, Los Angeles, Calif.
George H. Finley, Los Angeles, Calif.
H. Elliott Taylor, San Francisco, Calif.
Craig Espy, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)
None.

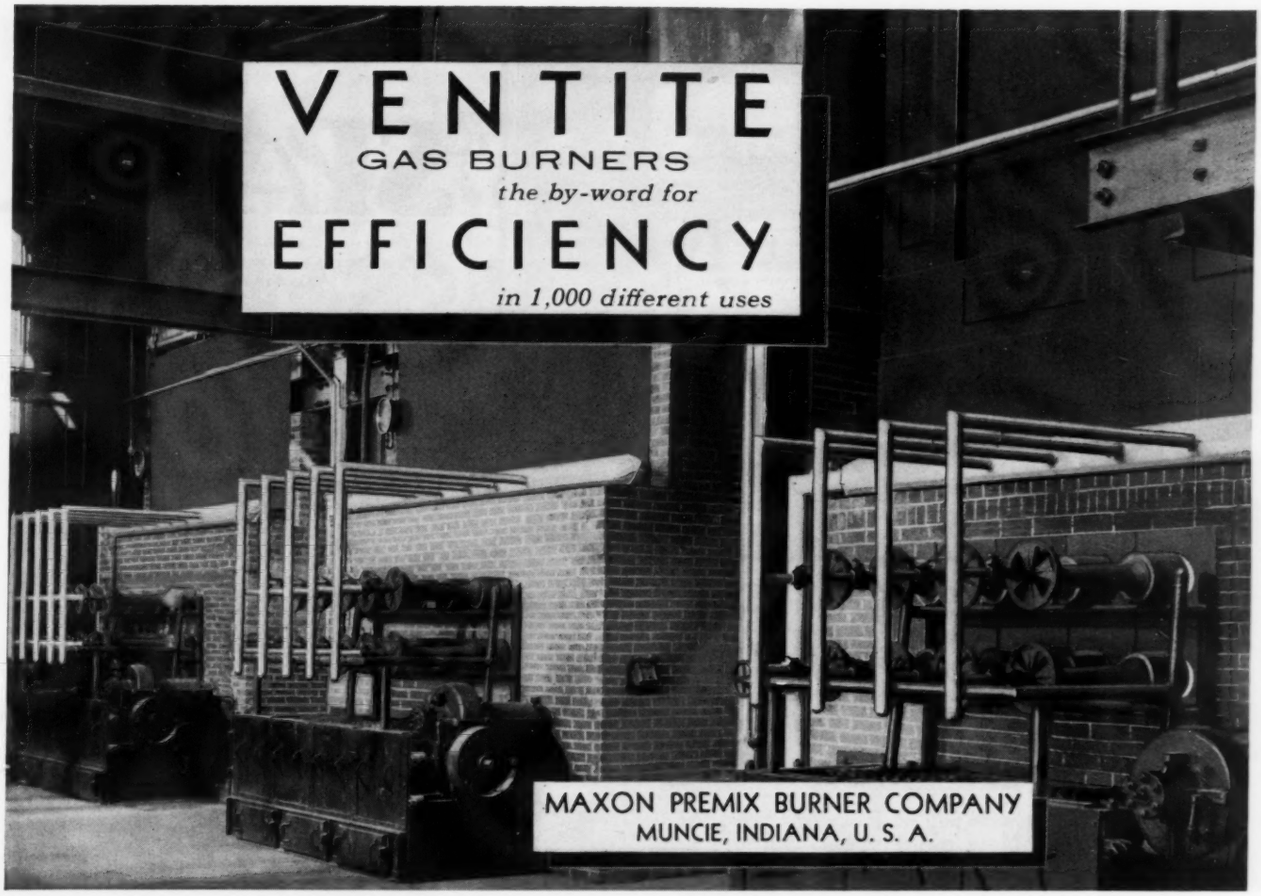
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only.)

JAY JENKINS, Publisher.

Sworn to and subscribed before me this 24th day of March, 1931.

(SEAL) JOSEPHINE C. WHITING,
Notary Public.
(My commission expires March 25, 1932.)

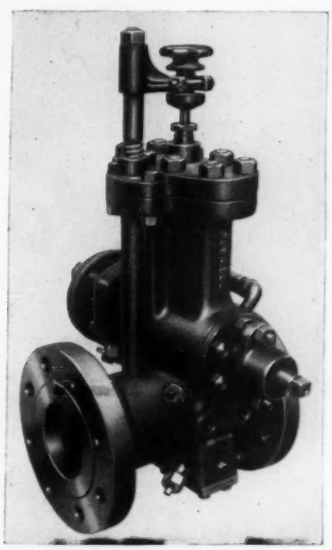


You Can't Afford to Guess . . . .

Don't take any chances with your metering equipment. Guessing is too expensive! Settle it once and for all by installing ROBINSON Orifice Fittings—the **proved** method that assures accurate and economical metering under all conditions.

No by-pass to leak and cause metering inaccuracy. **All** gas goes through the orifice and is correctly measured. No hazard because gas cannot leak when changing plates. Orifice is **always** centered and plates can be changed in a fraction of the time necessary under ordinary methods. Occupies little space and can be installed in almost any position. Saves labor and materials.

To get the complete story of Robinson efficiency, simply request latest catalog. Or ask any user of Robinson Orifice Fittings.



ACCURATE METERING THROUGH OIL FIELD, REFINERY AND TRANSPORTATION PIPE LINES

NEARLY 13,500 IN SERVICE

ROBINSON ORIFICE FITTING COMPANY

1435 SANTA FE AVENUE
LOS ANGELES, CALIF., U. S. A.

Distributors
The Foxboro Company—Foxboro, Mass.
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CANADA—Peacock Brothers, Limited
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ENGLAND—Walker, Crosweller & Company
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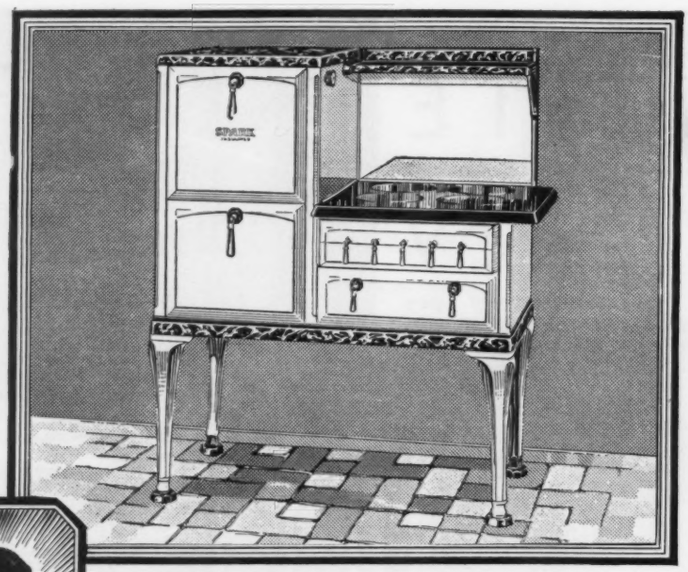


The New

SPARK

"Senorita"
LID-TOP

(Patented; other Patents Pending)

We are pleased to announce that the reception accorded the "Senorita" is the most gratifying in the the thirty years history of Spark Stoves.

Write for Information

ARISTOCRAT OF STOVELAND

New marbled porcelain trim
Moisture proof re-inforced insulation
Aereated concealed manifold
One-piece porcelain lid-top
New giant speed burners
Rounded corners—easy to clean

Hammer-Bray Co.

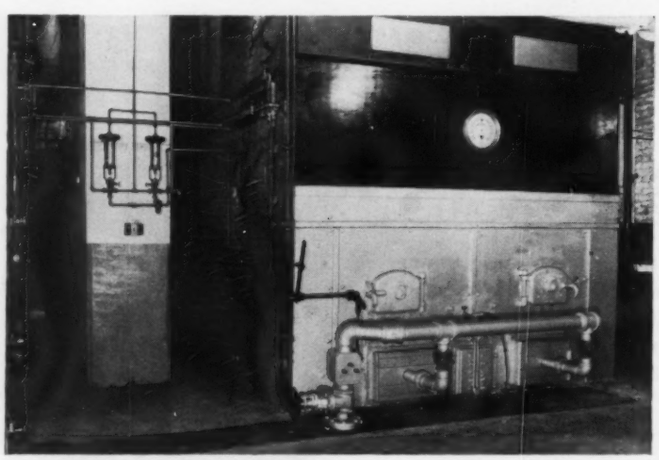
OAKLAND CALIFORNIA

LOS ANGELES
7000 Avalon Blvd.

SAN FRANCISCO
180 New Montgomery

PORTLAND
330 Union Ave. North

SEATTLE
1016 1st Ave. South



PEABODY HOTEL—Webster Gas Burning Equipment used in this Hotel

WEBSTER
ENGINEERING COMPANY
Tulsa, Oklahoma

DIVISION OF
SURFACE COMBUSTION CORPORATION
TOLEDO, OHIO

We Congratulate

QUALITY EFFICIENCY SERVICE *with* SPEED

the Memphis Power and Light Company on their wonderful work in introducing natural gas in Memphis. Also, their efforts in making the Natural Gas Convention a real success. We want to thank all of the gas utilities for the real cooperation and business they have given us in the past year and ask all of you to visit our headquarters in the Peabody Hotel during the Convention to partake of some real Webster Hospitality and give us a chance to thank each one of you personally. Webster Gas Burning Equipment can be seen in Peabody Hotel through courtesy of Mr. Stanton, Chief Engineer, and installations of many different types may be seen in Memphis through the courtesy of L. H. Hungate, Jr., Memphis Power & Light Company.

THE CLEVELAND BABY DIGGER

Runs Up High Trench Footage Runs Down High Trench Costs

MANY tests on hundreds of mighty tough jobs have proved to users in all parts of the country that the Cleveland Baby Digger will deliver maximum trench footage at minimum cost. Of course, there's a reason—many reasons.

If the job is to be done in the close, confined areas of cities and suburbs, through narrow alleys, close to or between obstructions such as hydrants, poles and fences, over soft tree lawns with the trees close together, then the extreme compactness of the Baby Digger (but 58 inches wide) and the fact that it carries no excess tonnage (weighing approximately 4 tons) assures you of fast, continuous machine digging and the elimination of practically all hand labor.

The extreme ease of transportation of the Baby Digger—it loads and unloads on its own specially built trailer in less than five minutes and travels to the next job at truck speed—makes practical and economical the use of machine digging on many short-line jobs.

The Baby Digger is amply powered for the toughest and hardest going, and sturdily and huskily built of the finest steels procurable. More machine jobs in more places at less trench cost is the performance that Cleveland Baby Diggers are regularly giving their users. Write today for catalog No. 10 giving complete specifications and full details.

THE CLEVELAND TRENCHER COMPANY

"Pioneers of the Small Trencher"

20100 St. Clair Avenue, Cleveland, Ohio, U.S.A.

Distributed by

Edward R. Bacon Co. San Francisco, Calif.

THE CLEVELAND BABY DIGGER

A System that assures a profit on Appliance Sales

AFTER an extensive survey in co-operation with a large number of public utility companies, Remington Rand has developed an appliance sales record that is based on a new and full conception of your merchandising and load building problems. A system that provides complete executive control and direction of all sales activities, a profit on appliance sales and an increased connected load.

The system provides every fact necessary to determine the sales potentialities of each territory as well as a selected list for direct mail advertising and promotion of special sales campaigns—a graphic saturation record showing number and kind of appliances in operation, distinguishing between those which are permanent fixtures on the premises and those owned by the present occupant, listing size of premises and whether or not owner occupied.

An active prospect record is also provided signalling the appliances for which each customer is a prospect and exact follow-up dates.

Special systems and forms have been developed for the following sales division activities—domestic appliances, home service, lighting sales, rural development, power sales, coke sales, house heating, industrial gas and sales management control. In each division non-productive effort is eliminated, number of calls increased, clerical duties reduced and sales stimulated.

If you are interested in increasing your present appliance sales, mail the coupon for full details of this system.

Public Utilities Department

Remington Rand

BUSINESS SERVICE

BUFFALO, NEW YORK

Remington Rand Business Service Inc.
Buffalo, N. Y.

I am interested in the system checked for increasing appliance sales.

Firm_____

Individual _____

Address _____

- ☐ Domestic
- ☐ Home Service
- ☐ Lighting
- ☐ Rural
- ☐ Power
- ☐ House Heating
- ☐ Industrial Gas
- ☐ Coke
- ☐ Salesmen Control

De Luxe WEDGEWOOD

IVORY AND BLACK OR GREEN
AND IVORY PORCELAIN FINISH

Top Gas Burner in heater firebox increases cooking-top space one-third. Gives six burner cooking capacity without increasing size of range.

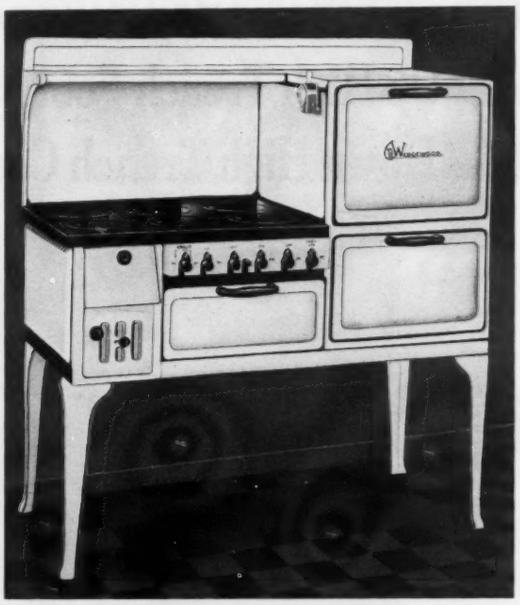
Concealed manifold is easier to clean and adds to the beauty of the range.

Circulator End Panel heats larger room area. Enameled Closed-Top assures greater convenience and is cleaner. Keeps kitchen walls cleaner.

WEDGEWOOD OUT SELLS ALL OTHERS BECAUSE IT OFFERS SUPER VALUE

Supreme in color charm and advanced design. "Ask the woman who owns one" what she thinks of her all porcelain Wedgewood Gas Range.

OVER A MILLION SATISFIED WEDGEWOOD USERS



May be had with or without Kitchen Heater.
Cast front . . . 16 inch Oven
Specify for Natural Gas or Manufactured Gas.

James Graham Manufacturing Company

Largest Stove Manufacturers in the West
Domestic and Restaurant Gas Ranges
San Francisco — Newark, Calif. Since 1882 — Los Angeles

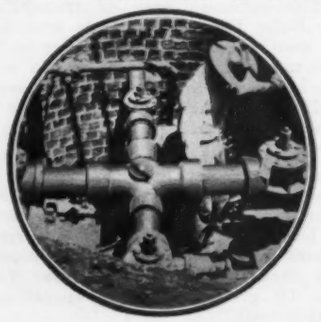
LAID TO LAST!

Above scene shows 10-inch Pacific States Cast Iron Pipe being laid in a western city, a modern pipe yet SAND-CAST. Western-made.

You are through with coating and coddling pipe when you lay Pacific States Cast Iron Pipe. It **cannot** rust. You lay it and forget it. Made as small as 1¼ and 2 inches, as large as 12 inch in 16-foot lengths.

"A Joint for Every Pressure"

At the right is a 4-inch Pacific cast iron Cross with Flexpan Joints in a cast iron main, under high pressure. Write for data on Pacific Pipe and Joints — recess-threaded without couplings, B. & S., plain-ends, etc.



Pacific States Cast Iron Pipe Company

Provo, Utah; Los Angeles, San Francisco, Portland, Denver, Dallas, Kansas City, Chicago, Salt Lake City.

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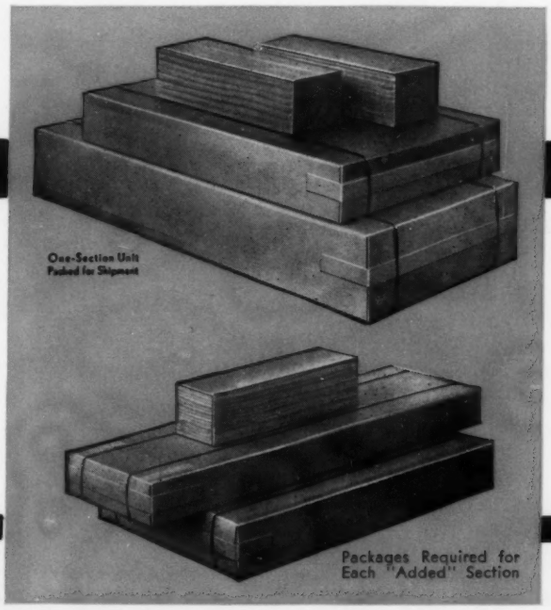

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